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Editorial and Reviewers' Board

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The current issue is the third of the twelfth volume of the *Athens Journal of Business & Economics (AJBE), published by the Business & Law Division and the Economics Unit of Athens Institute.*

Gregory T. Papanikos
President
Athens Institute

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A World Association of Academics and Researchers

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The Economics Unit of Athens Institute, will hold its **19th Annual International Symposium on Economic Theory, Policy and Applications, 29-30 June & 1-3 July 2026, Athens, Greece** sponsored by the Athens Journal of Business & Economics. The aim of the conference is to bring together academics and researchers of all areas of economics and other related disciplines. You may participate as panel organizer, presenter of one paper, chair a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2026/FORM-ECO.doc).

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- Dr. Henry Thompson, Head, Economics Unit, Athens Institute & Emeritus Professor, Auburn University, USA.
- Dr. Chris Sakellariou, Head, Economics Unit & Associate Professor of Economics, Nanyang Technological University, Singapore.

Important Dates

- Abstract Submission: **DEADLINE CLOSED**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **DEADLINE CLOSED**

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The Social Program Emphasizes the Educational Aspect of the Academic Meetings of Athens Institute.

- Greek Night Entertainment (This is the official dinner of the conference)
- Athens Sightseeing: Old and New-An Educational Urban Walk
- Social Dinner
- Mycenae Visit
- Exploration of the Aegean Islands
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3-8 May 2027, Athens, Greece

The Business, Economics and Law Division (BLRD) of Athens Institute is organizing its **14th Annual International Conference on Business, Law & Economics, 3-8 May 2027, Athens, Greece,** sponsored by the Athens Journal of Business & Economics and the Athens Journal of Law. In the past, the six units of BLRD have organized more than 50 annual international conferences on accounting, finance, management, marketing, law and economics. This annual international conference offers an opportunity for cross disciplinary presentations on all aspects of business, law and economics. This annual international conference offers an opportunity for cross disciplinary presentations on all aspects of business, law and economics. Please submit an abstract (email only) to: atiner@atiner.gr, using the abstract submission form (https://www.atiner.gr/2027/FORM-BLE.doc)

Important Dates

- Abstract Submission: **6 October 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **5 April 2027**

Academic Member Responsible for the Conference

- **Dr. Gregory T. Papanikos**, President, Athens Institute.
- **Dr. Michael P. Malloy**, Director, Business, Economics and Law Division, Athens Institute & Distinguished Professor & Scholar, University of the Pacific, USA.
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Challenges in the Formation of a U.S. De Novo Bank in the Wake of the 2023 Regional Banking Crisis

By Ryan A. Chang[*] & Mark A. Tribbitt[±]

The 2023 banking crisis in the United States was precipitated by a duration mismatch between customer deposits and bank investments, resulting in the failure of several banking institutions, including two prominent banks in Northern California: Silicon Valley Bank and First Republic Bank. In response to these failures, the already stringent regulatory framework governing the U.S. banking sector tightened even further to mitigate the risk of future collapses. The aim of this paper is to discuss the challenges that a group of bank organizers faced in the ambitious task of planning, establishing, and launching Altos Bank, the first de novo bank in Silicon Valley in nearly 20 years, in the middle of this regional banking crisis. The methodology incorporated interviews with bank board directors and executives, and analysis of the written interactions of the bank with state and federal regulators. The net findings of our analysis revealed that over the course of two years and despite numerous challenges, the Altos Bank organizers successfully brought the bank to fruition. While this assessment is limited to the challenges with respect to the formation of a single bank within a regional banking crisis, the findings may prove beneficials for other de novo banks navigating the regulatory process in a period when many new bank applications across the United States were either abandoned or withdrawn. This paper will examine the critical investment, legal, regulatory, and diversity-related challenges encountered during the formation of Altos Bank.

Keywords: *banking crisis, de novo bank, FDIC, First Republic Bank, Silicon Valley Bank*

Introduction

At the start of 2022, the banking sector in the United States appeared poised for a favorable year. Interest rates remained low due to ongoing economic stimulus measures implemented in response to the global Covid-19 pandemic. The U.S. GDP grew at a robust rate of 5.7%, marking the highest annual growth rate since 1984 (BEA 2022). Banks experienced significant liquidity, with total deposits increasing by 35% in the two years between the end of 2019 and the end of 2021 (Castro 2022). Furthermore, low interest loans and lines of credit allowed businesses to borrow money from banks at very little cost, with many of these low interest lending programs supported by the U.S. Federal Reserve (Minoiu et al. 2021).

However, 2021 also witnessed a surge in inflation which reached 4.1% -- the highest annual rate since 1991 (Ball et al. 2022) (Jahromi et al. 2023). This inflation was largely driven by monetary stimulus from the Federal Reserve and

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fiscal stimulus from the U.S. Government, both attempting to intervene in response to the sharp but brief economic slowdown caused by the worldwide Covid-19 pandemic. Guided in part by the monetary policy framework previously established by economist John Taylor, the Federal Reserve initiated a series of interest rate hikes to combat inflation (Taylor 1993) (Wang 2024). The first Federal Reserve rate increase, a modest 0.25%, occurred on March 17, 2022. This was followed by ten additional rate hikes totaling 5% by the summer of 2023, resulting in a Federal Funds target rate of 5.25-5.5% (Shi 2024). These rate increases dramatically changed the environment in banking. The opportunity cost of holding cash in non-interest bearing checking accounts rose sharply, while borrowing costs for business lines of credit increased substantially, creating a challenging environment. It was against this backdrop in March of 2023 that a regional banking crisis evolved in California which would eventually take down the 15th and 16th largest banks in the United States. However, during this period questions arose about the possibility for the formation of a new bank in the center of the region associated with the crisis. The research question sought to be addressed in this paper was to analyze the challenges that a new *de novo* bank would face when seeking approval during the crisis.

Literature Review

Banking crises have been common over the last 40 years, with 151 systemic banking crises occurring between 1970 and 2017 (Laeven 2020). A number of financial studies have evaluated the causes of these systemic banking crises and found a common set of circumstances (Demirgüç-Kunt and Detragiache 1998) (Kaminsky and Reinhart 1999). The genesis for these crises is a deregulatory environment that allows for expansionary credit policies. These credit policies are followed by an increase in asset prices, which, if extreme, can lead to financial bubbles. The bursting of these bubbles leads to a rapid decline in asset prices, which lead banks to adopt a tight credit policy. Increases in non-performing loans and worsening liquidity problems cause banks to falter, and in many cases require governments to step in to support the banking system (Englund 1999) (Kaminsky & Reinhart 1999).

In contrast, the regional banking crises of 2023 was not related to national liquidity issues or significant devaluation in assets. This banking crisis was centered largely in the San Francisco region of California, where several banks had large average customer deposits. A significant number of these deposits exceeded the Federal Deposit Insurance Corporation (FDIC) mandated $250,000 insurance coverage and were thus "uninsured," which was not a concern for depositors when these banks were noting significant growth in deposits and assets. However, a fundamental shift in these high deposit clients moving deposits out of several regional banks from the fourth quarter of 2022 through the first quarter of 2023 rapidly contributed to the 2023 regional banking crisis (Chang et al. 2024). Most of these deposits were transferred to the largest banks in the United States, those with assets greater than $250 Billion, which were believed to be large enough to weather any liquidity issues and provide a greater sense of safety for deposits (Caglio et al. 2024). In the first few months after the start of the 2023 regional banking crisis, deposits at

large banks grew 2 to 3% higher than smaller banks, confirming a flight to safety (Chang et al. 2024).

In Northern California, Silicon Valley Bank (SVB) and First Republic Bank (FRB) were the focus of attention during this regional banking crisis. During the years preceding 2022, both banks noted significantly increased deposits. In the low-interest rate environment of 2020-2022, both SVB and FRB chose to place these excess deposits in long term bonds in order to obtain higher returns as the Federal Funds rate through much of that period was close to zero (target range 0 to 0.25%) (Vo and Huong 2023). Following an initial Federal Reserve rate hike in March 2022, and through the series of subsequent rate hikes, consumers and firms now had ample alternatives to place funds in order to maximize interest returns. It became less rational to leave large amounts of cash in non-interest-bearing checking accounts when CD rates and money market rates approached and then in some cases exceeded 4%. Simultaneously, there was a significant pullback in venture capital funding, requiring firms that had previously raised cash to draw on their bank deposits to meet expenses; a reduction in the amount of new funding resulted in firms utilizing savings. These two factors, higher rates elsewhere and cash demands on deposits of companies in the region, both precipitated a demand for increasing cash withdrawals of SVB and FRB.

SVB had customer demographics that would potentially precipitate the demand for large cash withdrawals. SVB catered to a large number of start-up firms, and as increasing cash demands were placed on SVB, a growing concern circulated among the venture capital industry that it may not be prudent to leave large amounts of cash at SVB because of questions regarding the insurability of deposits larger than $250,000 per customer and whether the bank could realistically meet increasing withdrawal requests. These issues came to a head on March 8, 2023, which is considered to be the start of the 2023 regional financial crisis (Federal Reserve Board 2023). On this date, SVB disclosed that it sold $21 Billion from its long-term bond portfolio for a $1.8 Billion loss along with a hastily prepared plan to raise $2.25 Billion through an equity offering (Silicon Valley Bank 2023). Additionally, on this date, a smaller bank in Southern California, Silvergate Bank, was forced to close its doors in large part due to cryptocurrency losses related to the collapse of FTX, a large cryptocurrency exchange (Silvergate Bank 2023). These events created a significant bank run on Thursday March 9, 2023, in which $42 Billion dollars in deposits were withdrawn on a single day. The $2.25 Billion equity raise by SVB was scuttled on the evening of March 9, 2023, when the massive withdrawal amounts from earlier in the day were announced (Metrick 2024). By the early hours of the following morning, March 10, 2023, there were questions of whether SVB could survive to the end of the day as withdrawals continued. As a result, the Federal Deposit Insurance Corporation (FDIC) subsequently took over SVB prior to the bank opening on Friday, March 10, 2023 (Metrick 2024). Over the next several days, in order to stabilize the financial markets and allay the concerns of bank depositors, the FDIC announced that it would guarantee all deposits, including those above the $250,000 level, and that cash would be available to any bank customers who wished to make a withdrawal. With depositors guaranteed, only the equity and bondholders in SVB ultimately

suffered losses. On Sunday March 26, 2023, after several weeks of negotiations with the FDIC, North Carolina based First Citizens Bank acquired the deposits and loans of the FDIC run intermediary named Silicon Valley Bridge Bank, ending the immediate SVB crisis (Hirsch 2023).

During the massive deposit withdrawals from SVB on Thursday March 9, 2023, FRB actually showed significant increases in deposits that same day, in part due to money moving from SVB to FRB. However, over the subsequent weekend, several articles appeared in the press noting that FRB had a significantly similar portfolio of long-term debt that was underwater as a result of rising interest rates (Branch 1997). By Monday March 13, 2023, FRB was seeing large amounts of net deposit outflows which continued for the next several weeks. On March 16, the ten largest banks in the US deposited $30 Billion in FRB to ensure that this bank did not fail (Benoit et al. 2023). These large banks believed that continual failures of regional banks would risk the regional banking crisis becoming a national banking crisis (Hachem 2024). However, failures to come up with a longer-term stability plan, a rapidly deteriorating FRB stock price, and credit rating downgrades by Standard and Poors ultimately resulted in the FDIC taking over FRB on May 1, 2023. Unlike the case with SVB where the FDIC ran the bank for several weeks prior to its sale, in the case of FRB the FDIC acquired and simultaneously sold FRB to JP Morgan Chase Bank through a competitive bidding process (Omar et al. 2023).

Methodology

The aim of this paper is to examine to what extent a regional banking crisis can impact the ability to form a de novo bank during the crisis period. While studies have shown that financial crises usually follow cyclical patterns, it can be difficult to predict both the timing and mechanism of the crisis (Jin et al. 2016). The loss of two large banks in Silicon Valley (and the 15th and 16th largest banks in the United States at the time) over a two-month period in the spring of 2023 created significant stresses in the financial markets. The Federal Reserve, President Joe Biden, and Treasury Secretary Janet Yellen all sought to allay fears among the public, highlighting that the US banking system was sound and that these few bank failures were isolated incidents. However, the fact that both banks that failed were based out of Northern California and, more specifically, the San Francisco Bay area, cast a pall on the financial sector throughout Northern California and created a heightened sense of uncertainty about banks among investors.

The loss of SVB, in particular, reduced the number of banks headquartered in Santa Clara County, the center of Silicon Valley, from four to three. Considering that in 1992, there were 17 banks headquartered in Santa Clara County, the three remaining banks in 2023 represented the remnants of an 82% reduction in banks founded in the county. Furthermore, the last *de novo* bank founded in Santa Clara County was 2008, and the last *de novo* bank founded in the adjacent San Mateo County was 2003 (Department of Financial Protection & Innovation n.d.). The regional bank crisis heightened scrutiny by bank regulators who tightened requirements for new and existing banks, and increased the legal guidance needed to navigate the

evolving requirements. It is against this backdrop of financial uncertainty that a focused group of organizers sought to launch Altos Bank, the first *de novo* bank in Silicon Valley in nearly 20 years. Multiple obstacles were encountered through the formation of this bank, with this paper focusing on the investing, legal, regulatory, and diversity challenges faced by the bank organizers through this process. Interviews with the Altos Bank Board of Directors and Executive team, and reviews of the correspondence with state and federal regulators were used as the basis for collecting data for this study.

Results

Investment Fundraising

Banks require capital and it is the capital that provides the basis for banks to take in deposits, which in turn allows the bank to make loans. The net interest margin, the difference between which banks charge for their loans and pay for their deposits, is the primary method through which banks generate revenue. In the State of California, The Department of Financial Protection and Innovation (DFPI) serves as the state banking regulator supervising the organization and operations of all banks in the state. California chartered banks are allowed to take in ten times the capital amount in deposits, and therefore a new bank with $25 Million in initial capital can take in up to $250 Million in deposits. Banks typically loan 85-90% of their deposits out as loans; $250 Million in deposits amounts to approximately $200-225 Million in loans. Thus, a sufficient supply of capital is necessary to launch a bank that will succeed, because until the *de novo* bank becomes profitable, it will need to survive on its capital. At present, it is believed that at a minimum of $20-25 million of capital is necessary to organize and start a bank. Altos Bank was capitalized in November 2024 with $27.8 Million after an intensive 30-day capital raise following conditional approval by both the FDIC and the DFPI.

However, raising this capital for Altos Bank was not without significant challenges. A major difficulty encountered by the organizers was the misperceptions that many investors had regarding banks as a result of recency biases based on the still fresh news of the failures of SVB and FRB. Compounding this observation, Altos Bank is situated in Santa Clara County, the same County as SVB. Many potential local investors had also been prior stockholders in SVB and FRB and saw their investments in these two banks completely lost. Additionally, many of the same investors sought out by Altos Bank for capital were impacted as customers of SVB or FRB and saw the confusion. Disarray, and frustration that came from the challenges at these two banks. These events gave the perception that investing in banks is a risky endeavor, and that if two $50 Billion in capital banks could not survive, then how would a new startup bank with $27.8 Million in capital fare? What was often overlooked by many investors is that from the beginning of 2021 through 2024, only seven of the 4577 federal and state-chartered banks in the US failed (American Banker Editorial Staff 2024). This represents less than a 0.15% failure rate over a nearly full four-year period of time. Despite this reassurance, several investors

either chose to make their final investment at a substantially decreased level compared to their initial pledged amount, or in other cases chose to cancel their investment in Altos Bank altogether. This necessitated having to fundraise from a larger base of potential investors than needed if there was not a regional banking crisis. Some of the most optimistic investors in Altos Bank reside outside of California, where the impact of the California regional banking crisis was likely negligible.

The location of Altos Bank within Silicon Valley invariably created comparisons of Altos Bank's potential with other startups in the region. This group of bank investors hesitated not because they were concerned about bank safety, but because they considered banks a slow and unattractive investment compared to the thousands of other startups present in the region, most of which have projected growth plans far exceeding growth rates seen in banking, a highly regulated industry. Even though SVB bank stock itself returned over 900 times an original investment from 1987 through 2022, generating approximately 22% annualized returns during this 35-year period, these returns were not appreciated by those enamored by the technology sector. Having the headquarters of Google, Apple, Nvidia, Broadcom, and Netflix in the same county (Santa Clara County), and Meta's headquarters in the adjacent county of San Mateo overshadowed any impressive returns of financial institutions located in the shadows of these giants. Ultimately, it was the identification and highlighting of banks in California that had annualized returns that compared to these technology giants that allowed investors the insight that, in the appropriate environment, banks could potentially provide above average returns even in a region dominated by technology companies.

Historically, new banks in California have been able to hire their executive team, submit their application, pass the regulatory processes, and complete their fundraising in 12-15 months. The guidance for the amount of seed capital needed for the formation of a *de novo* bank is based on this estimated timeline. The challenges with the failures of SVB and FRB, as well as the lack of any *de novo* bank formation in Silicon Valley over the last 15-20 years resulted in an extended timeline, as bank regulators in the region had not had any recent experience with approval of new banks over the last several decades; several of the younger regulators had never before participated in the approval of a new bank. The failures of SVB and FRB in the region also created a very meticulous, conservative timeline for regulatory approval. As a result, the timeline from the organization of the precursor of Altos Bank to the actual opening of Altos Bank was nearly two and a half years. As a result of this extended timeline, a significantly larger amount of seed capital was needed than would be required for a previously typical 12-15 month approval window. Furthermore, to the dismay of the Altos Bank organizers, the longer time window allowed some investors who had verbally committed capital to the bank during 2023 to alter or even cancel their actual investment once funds were due in October 2024.

A final challenge encountered during the fundraising aspect of Altos Bank was that certain investors, perhaps misrepresenting either their interest in the bank or financial ability to invest, did not initially follow up on their pledge to invest in the bank during the period of time in which the capital round was open. Repeated contact with these potential investors consumed a disproportionate amount of time and resources, diverting bandwidth away from those investors who had a sincere

intent and capacity to invest. As a result of this experience, the organizers of Altos Bank learned a great deal regarding the disproportionate effort that it would take to raise funds from specific investors, and more importantly, how to identify and focus on those investors with a genuine intent to support and invest in the bank.

It also became clear to the bank organizers that even in Silicon Valley, a small number of investors misrepresented their financial acumen, wealth, and capacity to follow through on their commitments. Some of these investors appeared to seek to invest only if they were offered something of value other than stock, such as bank employment or referral fees for bringing other investors. Others seemed to be outright charlatans, claiming to have financial resources that never materialized. While the majority of investors followed through with their pledges to invest, the minority of investors who expressed interest in participating in the funding round but then did not invest, led to frustration on the part of the board and executive team.

Legal Aspects

As expected with the complex regulatory environment that exists with the formation of a *de novo* bank in California, comprehensive legal guidance is necessary to adhere to all the DFPI and FDIC regulations. Understanding the legal aspects of the regulatory environment around new banks are significantly different from the requirements of any other type of startups.

All documents related to the investment in a *de novo* bank are required to undergo review by DFPI and FDIC regulators. These include slide decks, offering circular and subscription agreements related to the bank investment. Even social media posts on platforms such as Linkedin, Facebook, and Instagram during the organizational period require regulatory review before being allowed for use. This oversight creates an environment in which organizers of the bank had to fundraise all while having significant restrictions on what could be communicated to investors during the process of raising capital. Information that is commonly presented for startups in most other industries, such as growth projections and pro forma financials, are prohibited by state and federal regulators to be included in the standard pitch decks circulated as part of the fundraising effort. The Altos Bank website also required formal regulatory review for each and every page on the website to ensure that it was acceptable to the DFPI and FDIC, and any violations required immediate correction.

The actual collection of funds from investors for a *de novo* bank is unique compared to other start-ups. In most new companies, the investors choosing to invest in the company make investments payable directly to the startup company. For a new bank, all investments are made to a third party escrow company, typically a banker's bank. This third party escrow company holds all funds related to the funding round, and can only release the funds to the new bank upon two criteria; 1) achieving a minimum amount of investment raise ($25 Million in the case of Altos Bank) and 2) approval for release of funds by the DFPI and the FDIC. Failure to achieve both of these goals results in funds being returned to investors, with the bank not realizing any receipts of the funding. As a result of these requirements, during the fundraising process of the capital round, Altos Bank was not able to use any of the funding until

the entire amount of funds had been raised, and the funding round closed and audited by the escrow company. During this period, even though nearly $25 Million in new capital was raised, Altos bank had to operate on the initial seed capital alone.

In addition to the largely rational legal aspects of a *de novo* bank formation, several nuances do exist in the formation of new banks in California. Of greatest significance, California is the only state of the fifty in the US that does not allow those investors who have made a seed capital investment in the precursor bank organization to "roll" their investment into the actual bank once it is formed. This requires the seed investor who has already made an investment in the precursor organization to make a second comparable investment in the actual capital funding round of the subsequent bank. This is then followed by a subsequent return of their seed capital once the bank opens. Particular regulation requires an investor to have liquid assets of twice their amount of his intended final investment in the bank, since the second comparable investment in the main capital round must be made before return of their initial seed capital. During the raise of capital for Altos Bank, a few investors had difficulty understanding this regulation despite its description in the investment documents. This created several instances where the Altos Bank organizers needed additional time and effort for multiple follow up discussions with these investors to clarify the situation and ensure that they had adequate liquidity.

Regulatory Challenges

Altos Bank submitted its bank application for creation of the *de novo* bank on May 12 of 2023. The bank regulatory environment in California at that time was one of significant tension, since three of the four banks that failed in 2023 were in California. State (DFPI) and federal (FDIC) regulators had a mixed response to the initial Altos Bank application. On one hand, they were encouraged by the fact that Altos Bank proposed to be the first new bank in Silicon Valley in almost 20 years, and regulators clearly understood that more competition in the banking industry was always welcome. However, the initial meeting with state and federal regulators and the proposed Altos Bank directors and management team occurred in the San Francisco FDIC building a little more than one month after the failure of SVB, and three days before the FDIC assumed control of FRB. As a result, tension and anxiety among regulators was high and amid this crisis, it seemed that the request by organizers of a new small bank would appear inconsequential. The regulators also stressed that they would place greatest emphasis on the experience of the proposed management team submitted in the application, the director's ability to raise capital, and the thoroughness of the business plan for the proposed Altos Bank. While the application was encouraged, the regulators indicated that they would be placing a high bar on these requirements.

The fact that no new bank had been approved in Silicon Valley for nearly two decades presented a challenge as a result of limited regulator experience. Many of the regulators had either not been involved with the *de novo* formation of a new bank, especially if they had been employed with the DFPI or FDIC less than 15 years. The loss of several senior regulators following the collapse of SVB and FRB further hindered the approval process for Altos Bank. As previously

discussed, this new regulatory environment resulted in a longer than anticipated timeline from submission to conditional approval by the DFPI and the FDIC. This variance in the time to approval required a larger amount of seed capital than initially expected, and a second seed round raise was completed to ensure adequate liquidity up to bank opening. The fact that this second round was required created some consternation among the investors in the initial seed round who remained concerned about the longer than expected timeline to approval.

A final regulatory aspect that applies to *de novo* banks in California that does not apply to standard startups are restrictions that the DFPI and FDIC place on maximum ownership by an entity or individual. Regulatory restrictions allowed Altos Bank to secure no more than 10% of its investment from foreign investors in aggregate. While this was intended to avoid any situation in which foreign investors or entities could acquire a controlling stake in a US based financial institution, it also hampered the Altos Bank organizers from utilizing the entirety of their fundraising universe, as many of the organizers' contacts were overseas. A number of Altos Bank Organizers had significant connections overseas in Asia, Africa, and the Middle East, and because the aggregate of all foreign investment could not exceed 10%, some foreign investors had to either reduce their investment amount in Altos Bank or be outright turned away. Additionally, DFPI regulatory requirements restricted no individual investor to acquire more than 9.99% of the bank stock and no individual entity (corporation, LLC, trust, etc) to acquire more than 4.99% of the bank stock, even if domestic. Substantial checks were performed by the regulators to identify any familial or business affiliate relationships among investors to prevent groups of individuals or entities from circumventing these limits. As a result, entities that would have been happy to invest larger amounts in Altos Bank were restricted to lesser amounts, requiring us to secure the difference from other investors and increasing the time needed to complete fundraising.

Diversity Challenges

One of the main challenges facing Altos Bank was how to maintain adequate gender and diversity among bank directors and employees, and to serve the diverse minority groups in the local region. Santa Clara, the county that Altos Bank is headquartered, is composed of over 70% minorities, and one of the missions of Altos Bank was to be a financial institution that would welcome these minorities, some of whom have been distrustful of financial institutions in the US due to language or other cultural issues. Latinos, Chinese, and Vietnamese, represent significant percentages of the local population. A primary goal of Altos Bank is to employ staff that understand the culture and can speak the language of these minority groups in order for them to feel welcome and comfortable in doing business with the bank. In larger organizations it is more likely that there are employees on staff that speak a variety of foreign languages, but with a small staff of 17 full time employees at the date of the Altos Bank opening, a concerted effort was needed to hire outstanding employees that were also multilingual. This necessitated interviewing larger number of potential employee candidates than would have otherwise been necessary.

In addition to the bank employees, diversity remained a challenge on the executive team in large part due to the bank's attempt to satisfy regulatory requirements. In California, the most important aspect that determines whether a *de novo* bank application is approved by regulators is the experience of the executive team. This experience translates to the intellectual capital of the bank, and studies have shown that this is critical in the success of the bank (Onumah and Duho 2019). However, requiring a CEO of a prospective *de novo* bank to have prior CEO experience as well as to have over 30 years of total bank experience reduces the pool of candidates to those who had started in the banking industry in the 1980s. At that time, banking was largely an occupation of white males. Finding C-level executives that were non-white was a significant challenge when restricting candidates to those with decades of experience. Fortunately, despite this challenge, Altos Bank was able to successfully hire one of the top three executives as a minority (Latino).

Like ethnicity, achieving gender balance can be a challenge in any startup, and this was no different with Altos Bank. Compared to established banks which, through their size, provide a potentially more stable job environment, startup financial institutions may be interpreted as a riskier career choice. While startup banks offer the potential for a more rapid promotion and career advancement than a large bank with tens of thousands of employees, the riskier perception of a start-up environment made conservative applicants more likely to decline offers of employment. While the experience was limited to the Silicon Valley region, a focused recruiting effort yielded only 5 women of the 17 employees of Altos Bank at the time of the opening of the bank. A concerted effort will need to remain in place to continue to balance gender, and as Altos Bank grows, it is expected that gender balance will be achieved.

Finally, diversity in race and gender also applies to the board of directors. Bank regulators expect at least one or two bank directors to be retired bank executives with decades of experience, and as with executives, it can be challenging to find non-white males that fit this role. Altos Bank has had much more success in maintaining racial diversity with board members who are not career bank executives. Four of the five directors who are not career bankers are minorities, including two Asian, one Indian, and one African American. Gender diversity on the board was a greater challenge than ethnic diversity. The Altos Bank board had undergone several changes during the two-year process to achieve bank approval. At one point half of the proposed Altos Bank board directors were women, but because of board adjustments made at the request of regulators, no women were represented on the board at the time of final bank approval. As with the employees, significant focus will be applied to add gender diversity back to the bank board moving forward.

Discussion

The 2023 bank crisis was a regional crisis which failed to expand into a larger systemic banking crisis. Many of the common events of a systemic banking crisis, such asset inflation followed by a crash in asset prices, liquidity problems, and a contraction in lending did not occur (Demirgüç-Kunt and Detragiache 1998) (Kaminsky and Reinhart 1999). However, subsequent analysis showed that reduced regulatory

oversight, typically seen in systemic crises, was a factor in this regional crisis (Federal Reserve Board 2023). Analysis by others appears to place most of the genesis of the 2023 crisis on two factors, the first being a rising percentage of uninsured deposits in a few select banks with a focus on high net worth and commercial clients (Chang et al. 2024). Clients of the banks that failed demonstrated fungibility of their funds during this crisis, easily moving funds out of specific banks to larger banks or brokerage firms with greater perceived safety. The second factor behind the 2023 regional banking crisis was the duration mismatch created between banks deposits and investments (Tsang 2024). During the several years leading up to the crisis, both short term and long-term rates were low, and several banks made the unfortunate decision to chase investment yield by purchasing longer term treasury bonds. These same institutions were then ill-prepared for the subsequent rising interest rate environment which lowered the market rates of their bonds to below face value resulting in large potential losses on their books if they chose to sell the bonds before maturity, a realistic possibility if their clients chose to withdraw deposits.

Even though the regional crisis of 2023 did not expand to become a systemic banking crisis, the fact that Altos Bank chose to incorporate and seek regulatory approval in Silicon Valley, the same region as the failed SVB and FRB, created significant challenges. *De novo* bank formation can be challenging, as evidenced by the lack of new banks originating in Silicon Valley during the 15 years preceding Altos Bank. However, adding the uncertainty of the regional banking crisis only compounded the difficulty. Investors, many of which were either investors or customers in SVB or FRB, were often reluctant to entertain an investment in a new small bank when two multibillion-dollar banks had failed within the last year. Many senior regulators assigned to the Northern California region were blamed for lack of proper oversight of SVB and FRB and were subsequently offered early retirement or transfer to other regions. This reduced the average age of regulators involved in the approval process of Altos Bank, and since many of these new regulators had not been employed as regulators prior to the formation of the last *de novo* bank in the region, the approval process likely took longer than planned.

A number of the requirements placed on the formation of Altos Bank, while appearing to have valid reasoning from the regulatory standpoint, had several potential consequences on Altos Bank. Restricting domestic investors to investing no more than a certain percentage of the capital stock required the organizers of Altos Bank to have to solicit investments from a larger number of people than otherwise, resulting in a longer timeline for the funding round and consumption of a larger amount of the seed capital. Requiring Altos Bank executives to have many decades of experience to be approvable as an executive of Altos Bank had the unintended consequence of reducing diversity and gender among bank executives, discrepancies that may take years to rebalance. In the end, Altos Bank successfully navigated the regulatory approval process, becoming the only new bank approved in California in 2024.

Conclusion

The formation and opening of Altos Bank were a long and arduous process that encountered many challenges from the initial formation of the bank board in the summer of 2022 to the actual opening of the bank in November of 2024. While a few of these challenges were expected, most of those encountered were not anticipated, were often discouraging, and required significant effort on the part of the board and the executive team to overcome. By addressing these challenges, Altos Bank emerged during the challenging post 2023 regional banking crisis at a time when most other *de novo* bank formations were either aborted or withdrawn by the bank organizers or declined by regulators. As a result, Altos Bank became the first new bank in Silicon Valley to open in nearly 20 years, and, as of December 31, 2024, Altos Bank was one of only two new banks approved in the entire United States during 2024 by banking regulators. These accomplishments by Altos Bank organizers, along with the excitement of success in creating a *de novo* startup within the established banking environment, foretells an amazing future in Silicon Valley.

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Portfolio Manager Ratings: k-Means and LDA versus Active Outperformance

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Consultants that serve in the benefit of institutional investors assign ratings to investment strategies (portfolios of assets) based on face-to-face interactions and other research activities referred to in the industry as 'due diligence.' Economic cycles change, and thus consulting firms often claim that ratings are 'forward looking,' reflecting portfolio performance two years into the future. Still managers of retirement accounts, endowments or foundations, make investment decisions for today, six months, or a year forward. In apparent contradiction of fiduciary responsibility, institutional investors would be better off selecting the portfolio strategies rated the lowest, to invest beneficiaries' funds, as our results show. Ratings only capture predicted outperformance two years forward, when portfolio managers are not shown to consistently exhibit skill. An 'arbitrage' of sorts, which investors with information on consultant ratings can take advantage of for up to three years, is to invest funds into portfolio strategies rated the lowest. We use dummy-variable estimation, k-means clustering, and linear discriminant analysis on the betas of fixed income portfolios against eight indices that describe the whole corporate credit curve. We discern patterns of outperformance versus the ratings.

Keywords: *relative performance, consultant ratings, clustering, discriminant score*

Introduction

A recently published book by Professor Emeritus Dr. George Bitros of the Athens University of Economics and Business, compares the retirement systems of several countries in the world, to that of Greece. The general conclusion is that a system based on performance, such as that of the United States for example, is more stable in the long run than that of Greece, which merely distributes over time income from younger generations into the older ones. However, a potential flaw of the system in the U.S. is that of pinpointing the responsibility of sound management of retiree funds.[1] Central role in this process is taken by investment advising/consulting firms, which in essence determine the allocation of retiree funds into investment portfolio strategies. This study utilizes established metrics in active management, including beta and information ratio (IR) to assess the efficacy of information produced by Morningstar, in its role as portfolio evaluator and issuer of one-to-five-star ratings. The metrics are crucial for evaluating investment strategies and for understanding how well a portfolio performs relative to its

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[1]Xanthopoulos A., *Η Περιπτωση των ΗΠΑ.* In Bitros (2024) G. Συνταξιοδοτικο: Το Προβλημα και η Λυση.

benchmark. **Alpha** measures the excess return of a portfolio compared to its benchmark, offering insight into the manager's skill in generating returns above the market, as represented by a stated benchmark. **Beta** captures portfolio sensitivity to the market index and quantifies systematic risk. **Tracking error** assesses the volatility of a portfolio's active returns, which helps measure the consistency with which a portfolio manager follows a mandate relative to the benchmark, while generating active performance. The **information ratio (IR)**, calculated by dividing alpha by tracking error, reflects risk-adjusted returns above the market benchmark. It is a key indicator of whether a manager is adding value relative to risks taken. These metrics are industry-accepted for evaluating active management strategies as objectively as possible, in addition to looking at ratings that consulting organizations assign. In this analysis, alpha in the typical sense is made as small as possible. Several market indices (eight of them) are used to siphon out as much of the potential out-of-benchmark performance. We use the betas against eight indices representing the corporate credit yield curve, as the x-variables and regress them against IR. Portfolio managers' decisions to buy and sell assets fall at the various parts of the yield curve. The assigned ratings should not deviate materially from the active outperformance generated here as Information Ratio (IR). But they do as we show, in a manner that may point to unintended breach of fiduciary responsibility.

Quantitative methods, based on industry metrics above as data, receive attention in the buy-side of the industry, largely due to the specter of 'Fiduciary Responsibility' regulation that is put in place by the U.S. Department of Labor. As a result, proactively assessing the efficacy of ratings has become an integral part of contemporary portfolio strategy performance measurement. These methods allow institutional investors to systematically classify strategies based on performance irrespective of the ratings assigned to strategies. Nevertheless, few of these studies are made public for understandable reasons. To handle complexity, financial actors implement machine learning methods, clustering algorithms such as k-Means, and classification techniques like Linear Discriminant Analysis (LDA)[2]. These techniques are robust approaches for identifying hidden patterns, improving predictive modeling, and optimizing investment portfolio selection. The combination of k-Means clustering and LDA has been extensively researched in several fields such as finance, risk management, and performance evaluation.[3] The method of k-Means, an unsupervised learning method, helps distinguish between classes, within the data according to the similarity of specific attributes, based on some measure of distance. This method lends itself well to separating investment portfolios by themselves (unsupervised) according to various characteristics, such as the beta coefficients and performance measures (risk-adjusted returns). Conversely, LDA is a supervised approach that is used to classify investment strategies according to their main characteristics. Here, the 'supervising' attribute is that of a strategy that has been recommended for investing based on consultant five-star-ratings, and the characteristics are the beta coefficients to eight indices, as above. We perform both kinds of tests, in addition to running a linear regression of risk-

[2]Hastie, T., Tibshirani, R. and Friedman, J., 2008. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*.

[3]Alzamil, Z. S., Appelbaum, D., Glasgall, W. and Vasarhelyi, M. A., 2021. *Applications of Data Analytics: Cluster Analysis of Not-for-Profit Data*.

adjusted returns against the eight indices, with ratings as binary (0,1) variables. We find that (a) the regression dummy variable for the least favorable Morningstar rating adds the most to the risk-adjusted outperformance (Information Ratio, IR), (b) for strategies not recommended, discriminant function scores align with actual risk-adjusted outperformance; and for those recommended these scores work against outperformance, (c) for the five clusters identified based on outperformance of the current month, six-months forward, 12-months forward and two years forward combined, we show that risk-adjusted performance is positively related to the linear discriminant score of recommendation based on ratings; obscuring the other negative relations between ratings and outperformance obtained in methods (a) and (b). The results of this study may be of interest in the regulatory arena of fiduciary responsibility, a full legal analysis of which is out-of-scope for this study. Briefly, the U.S. Securities and Exchange Commission and the Department of Labor have attempted to regulate the payments by various methods imposed on investment management firms[4]. Morningstar assigns ratings to investment managers, which are in essence classification schemes that are based on face-to-face interaction with portfolio managers, and a subsequent assignment of 'Stars' (one through five, in the case of Morningstar). This activity may entail fiduciary responsibility, to a degree that is out of scope. The Investment Adviser's Act of 1940 prescribes that "advisers" must evaluate portfolios in a "disinterested" manner that involves "reasonable care to avoid misleading clients."[5] The Fiduciary Rule finalized in 2016 under the Obama administration, broadened the definition of when a person or entity took on fiduciary responsibilities. Before that time, investment advisors fell outside the definition of 'fiduciary' and therefore, kickbacks from rated portfolio managers toward the rating advisers were not only legal, but common practice. To curb these practices, DOL's new ERISA rules expanded the definition of a fiduciary and created a new method of exempting certain prohibited transactions. But this DOL Law was vacated, in 2018, reinstated in 2024 and immediately challenged in court.[6] The rule "requires retirement investment advisors to provide prudent, loyal, and honest advice free from overcharges."[7]

The contributions of this study are that: (i) a set of relatively straight-forward methods to quantify the efficacy of any ratings of investment managers involves linear regression with dummy variables, a method that could be easily implemented as a quality control measure in any firms assigning ratings, (ii) ratings and outperformance are inversely related in the short run, for possible reasons related to the business cycle or an assessment-to-rating time gap, and not to intentional breach of fiduciary duty, (iii) ratings align with risk-adjusted outperformance two years forward, based on autoregressive level-1 forecasts of Information Ratio; however, investment managers consistently produce negative alpha two years hence, (iv) institutional investors may have to wait for two years before the efficacy of ratings becomes apparent, that is, before better (lesser) outperforming strategies are rated

[4]The Office of Compliance Inspections and Examinations, 2005. *Staff Report Concerning Examinations of Select Pension Consultants*.
[5]Barbash B. P., and Massari, J., 2008. *The Investment Advisers Act of 1940: Regulation by Accretion*.
[6]Alsdorf, G., 2024. *DOL Fiduciary Rule Saga Continues: 2024 Fiduciary Rule Halted by Texas District Courts*.
[7]Menickella, B., 2024. *The DOL's Final Fiduciary Rule is Here. See What's Inside!*

higher (lower) by consultants, (v) the relation between consultant ratings and risk-adjusted performance of rated strategies is not as expected: strategies that based on ratings would have been recommended for investment should exhibit performance that is higher than those not recommended. Instead, there are highly recommended strategies that exhibit dismal performance across time forecasts. There appears to be only an imprecise, vague positive relation between clusters of performance and ratings.

Literature Review

Applying k-means clustering and linear discriminant analysis (LDA) provides a methodical way to generally assess financial market performance, improve portfolio allocation, and help the institutional investor select investment strategies based on performance relative to a benchmark within a comparable investment peer group.[8] We examine the use of these methods in the finance literature, particularly in performance metrics, manager selection, and the assessment of efficacy of consultant ratings. The literature explores empirical studies that portray the effectiveness of clustering models, summarizes and identifies important findings, and points to areas that warrant further exploration. Understanding the need of k-Means clustering and LDA in performance evaluation allows institutional investors to improve their decision-making process, leading to better-quality portfolio management selection. Several studies have highlighted the importance of these metrics in determining the success of investment strategies. Chalmers et al. (2020) examine the impact of financial intermediaries on investor returns, suggesting that investors who rely heavily on intermediaries face higher fees and risks without necessarily achieving superior outperformance. This finding aligns with the broader critique of traditional investment strategies, where active management often fails to justify the additional costs. By contrast, focusing on objective metrics like the information ratio could allow for a more transparent evaluation of portfolio performance, providing clearer insights into whether managers generate value beyond the benchmark. The role of classification schemes in influencing investment decisions has also been widely debated. Many traditional classification systems rely on outdated or overly simplistic criteria that may not fully capture a portfolio's potential. This study contrasts such approaches by introducing machine learning models, trained on fund outperformance and Morningstar ratings, to describe investment strategy selection. The use of machine learning offers an opportunity to go beyond traditional classification schemes, uncovering patterns and correlations in data that are not evident through conventional analysis. These models when applied correctly offer accurate and dynamic assessments of investment strategies, aligning with the research by Gennaioli et al. (2015), who argue that financial advisors often exploit investor biases, amplifying market volatility. Also, Chalmers et al. (2012) highlight the conflicts of interest that arise from financial advisors' fee structures, noting how these incentives often lead to underperforming portfolios. When compensation is tied to the sale of specific products or services, there is significant risk of misalignment with the best interests

[8]Roberts, R, Potthast, C. and Dellaert, F., 2009. *Learning general optical flow subspaces for egomotion estimation and detection of motion anomalies*.

of the client. In such environments, it is essential for investors to have access to unbiased recommendations aided by quantitative methods above. We support the argument that machine learning models, by providing more data-driven and objective evaluations, mitigates some of these conflicts, giving institutional investors better tools to assess their options.

Despite general concerns over potential market destabilization due to these rating schemes, little publicly available evidence of systemic risks has been observed in the general literature. Gennaioli et al. (2015) discuss how money managers often cater to investor biases, which can lead to greater market volatility and noise trading.[9] However, this research suggests that when rating schemes are applied transparently, they contribute to more effective decision-making by providing a structured framework for evaluating investment strategies. In our view, rating schemes are not applied very transparently, or the Department of Labor would have no reason to reinstate the Fiduciary Rule Law. And the integration of statistical learning models enhances this process by enabling a more nuanced analysis that considers historical performance, in addition to consultant ratings. Another significant area explored in the literature is the impact of institutional investors on investment outcomes. Goyal (2008) demonstrates that larger institutional investors, who are less reliant on consultants, often achieve better investment outcomes compared to smaller investors, who are.[10] This observation suggests that institutional investors benefit from scale and expertise, which enables them to navigate complex investment landscapes more effectively. On the other hand, smaller investors need to rely more heavily on outside classification schemes such as ratings as a means of simplifying and justifying a decision-making process. The tools presented here, if used properly, provide valuable insights into investment performance and help smaller investors make informed decisions. On the one hand, dependence on outside ratings exacerbates the issue of responsibility-transfer from the plan sponsor to the consulting firm.[11] On the other, overreliance on statistical systems could lead to suboptimal outcomes, especially if the underlying metrics are not sufficiently robust. We propose some robust estimation methods, in this paper.

For example, k-means clustering as used in portfolio analysis, identifies a set of requirements in investment and portfolio construction that are critical in the present financial landscape, which is highly quantitative, wherein portfolios are categorized based on various quantitative factors. As financial markets have become more complex, data-driven approaches to decision-making have long been considered critical to success. The trend towards utilizing machine learning algorithms, and specifically clustering algorithms such as k-Means and classification techniques such as Linear Discriminant Analysis (LDA), has taken hold (Hastie, et al., 2025). These are powerful methods that can assist in discovering hidden patterns in financial data and in supporting predictive modeling and optimizing investment strategies.[12] The method of k-means clustering combined with LDA has been studied in numerous

[9]Gennaioli, N., Shleifer A, and Vishny, R., 2015. *Money Doctors*.
[10]Goyal, A. and Wahal, S., 2008. *Selection and Termination of Investment Management Firms by Plan Sponsors*.
[11]Xanthopoulos, A., 2019. *Investment Advising: Pay-to-Play, or Capture?*
[12]Cornell, B., S. Cornell, and A. Cornell, 2018. *The Conceptual Foundations of Investing: A Short Book of Need-to-Know Essentials.*

domains, from finance to risk management and performance appraisal (Roberts, et al., 2009). K-means clustering is an unsupervised learning technique that divides data into separate groups or clusters based on common characteristics. It can be effectively employed for grouping investment portfolio terms of risk-adjusted returns, beta coefficients to market indices, and other relevant performance measures. In contrast, LDA is a supervised classification method that sorts financial strategies through key attributes, enabling predictions of potential outperformance in varying market circumstances.[13] Thus, combining the aforementioned methods of k-Means and LDA aid in creating a systematic methodology for assessing feedback on financial strategies, optimizing portfolio selection, and performance relative to peers in the same asset class.[14] Therefore, the methodologies are employed in finance, performance measurement, manager selection, and clustering of average-performing strategies. They are used in exploring empirical research that shows model effectiveness, identifying key findings, and proposing future research avenues. K-Means clustering and LDA for performance evaluation enable investment professionals to better understand their decision-making processes and establish more advanced techniques for managing investment portfolios.[15] We subdivide the ways that these techniques have been used in general portfolio performance evaluation, below.

Linear Discriminant Analysis (LDA) is a classification technique that differentiates between groups based on their attributes (Hastie, et al., 2009). When integrated with k-means clustering, LDA scores provide a comprehensive framework for ranking investment strategies (Brown, et al., 2020). Studies have demonstrated that LDA models effectively classify portfolio managers into performance categories by utilizing key financial indicators such as alpha, beta, and IR (Alzamil, et al., 2021). By leveraging discriminant function scores, investment analysts refine decision-making processes and enhance the predictive power of financial models.[16]

Cornell (2018) investigates combining clustering with LDA in evaluating portfolios. The result is dividing financial strategies into several higher aggregated clusters, which offer lower complexity based on performance measures (Roberts, et al., 2009). Evaluation of performance based on these clustering techniques can provide insights into financial data as strategies with similar features are grouped. Corresponding outliers identified as high-performing clusters have been found to have shared common risk factors like tracking error and persistent alpha generation. (Alzamil, et al. 2021). Clusters with high LDA scores have been shown to have higher average returns over the long run than lower-rated clusters (Brown, et al., 2020). In this study we apply clustering techniques and compare the results to LDA-based classifications.

Clusters of moderate fund performance, in conjunction with average LDA scores offer insight into exposure-based strategies providing modest returns (Alzamil, et al.,

[13]Brown, T. B., *et al.*, 2020. *Language Models are Few-Shot Learners*.
[14]Gray, P., and Johnson, J., 2011. *The relationship between asset growth and the cross-section of stock returns*.
[15]Renjith, S., Sreekumar, A. and Jathavedan, M., 2021. *A Comparative Analysis of Clustering Quality Based on Internal Validation Indices for Dimensionally Reduced Social Media Data* in *Advances*.
[16]Lossio-Ventura, J. A., Gonzales, S., Morzan, J., Alatrista-Salas, H., Hernandez-Boussard, T. and Bian, J., *Evaluation of clustering and topic modeling methods over health-related tweets and emails*.

2021). Research in this area has concentrated on showcasing as well as portraying the typical intensity of group execution and investment choices (Cornell, et al., 2018). In this work we employ clustering and LDA techniques, to assess the efficacy of ratings assigned by Morningstar, on some fixed income portfolio strategies. The actual selection of strategies is relied upon by the institutional investor. In conclusion, this literature review highlights the delicate balance between reliance on objective performance metrics and the careful application of outside classification schemes, such as ratings. While concerns over advisor conflicts of interest and the potential risk of rating systems remain, this study demonstrates that innovative tools in statistical learning can provide significant advantages in selecting active managers. Unfortunately, the study also points to the fact that the ratings obtained by at least one investment advisor may mislead. By uncovering patterns in data that traditional methods overlook, statistical learning has the potential to reshape the investment landscape, offering investors more accurate and timely insights into strategy performance. Rating schemes, when applied transparently and in conjunction with advanced analytical techniques, can enhance decision-making and contribute to better institutional investor performance outcomes.

Methodology

Admissible investment strategies employed in retirement plans, endowments, and foundations, specifically focus on "long-only" investments but still fall within three key asset categories: fixed income, equity, and hedge funds. We focus on actual long-only fixed income strategies currently available for investment. The categories of fixed income are further subdivided into universes, such as Aggregate Bonds, Corporate Bonds, Emerging Market Bonds, etc. This methodology outlines the data collection, performance evaluation, and comparison of actual portfolio outperformance to the ratings assigned by Morningstar on these same portfolio strategies. The primary data source for this analysis was Yahoo Finance, where the Net Asset Value (NAV) and monthly returns for a variety of investment strategies were obtained, for the period of October 2018 to September 2023. Yahoo Finance offers a wide array of publicly available financial data, which makes it an ideal resource for this study. Performance and risk ratings provided by Morningstar, available through Yahoo Finance, were integrated into the dataset to help evaluate the relative performance and ratings efficacy of investment strategies. These ratings offer insights into how each strategy performs relative to its peers, based on opinions and contact with the manager by consultant/advisors.

The first step in the methodology involved filtering the dataset to select investment strategies based on predefined criteria within General Corporate Bond, which is a universe in fixed income portfolios. This process ensured that only those strategies with complete data were included in the analysis, while strategies with missing data or discrepancies were excluded or cleaned before further processing. Using Excel Visual Basic for Applications (VBA) the dataset was filtered to focus specifically on strategies that had data for a rolling sample of at least the last 24 months, as this time frame allows for more stable and reliable analysis. The goal was

to ensure that all strategies selected for analysis were comparable in terms of data completeness and relevance.

The second step involved rolling regression to measure the performance of selected strategies over time. Specifically, 24-month rolling windows of data were used for 36 strategies within the "Aggregate Bond" universe:

Rolling Regression to Benchmark: We regressed each strategy's returns against eight preselected indices to measure the relationship between the strategy's performance and the benchmarks. The selected indices comprised the Bloomberg Global Aggregate Bond and seven ICE/BofA Corporate Bond Total Return indices that span the whole corporate credit curve (AAA, AA, A, BBB, BB, B, CCC).[17] The regression output provided insights into the degree of correlation between the strategy and the benchmarks, and the resulting beta coefficients were used as independent variables to explain risk adjusted performance (Information Ratio, IR). The 24-month rolling returns for the selected 36 strategies were regressed against the benchmark indices. These regressions formed the foundation for understanding how each strategy performed in comparison to its benchmark betas. The results allowed for a better understanding of strategies generating alpha based on how they responded to changes in market conditions through betas.

Rolling Information Ratio (IR): The Information Ratio (IR) for each strategy was calculated to assess risk-adjusted performance. The IR was derived by subtracting the benchmark returns from the strategy's returns and dividing that difference by the tracking error (standard deviation of active returns). This metric was used to gauge how much value each manager was adding above the benchmark, adjusting for risk. By regressing the IR values of all strategies against the betas obtained as above, the study identified strategies that consistently outperformed their benchmarks versus those that were prone to underperformance, given their risk levels.

Regression of Information Ratio (IR): To explore the relationship between market exposure and risk-adjusted performance, the IR values were regressed against the strategy's beta coefficients. Beta measures the sensitivity of the strategy's returns to overall benchmark movements. This regression was designed to evaluate how much market exposure contributed to overall risk-adjusted returns and to see whether active management added value beyond market movements. The IR values were analyzed by regressing them against the beta coefficients of each strategy. This step assesses the credit levels of market exposure which affected active returns. The process is repeated four times, for Information Ratio of the Current Month, of six months forward, twelve months forward and two years forward, with an Autoregressive-level 1 model.

The third step involved producing reports, in the form of data on betas and IR. Statistical methods of linear regression, linear discriminant analysis (LDA), and k-means clustering were applied to data on reports produced. Regressing IR against betas of credit exposure provided the contribution to IR generated by such exposure. After that, the regression model was augmented with dummy variables, each capturing the five-star ratings assigned by Morningstar. The results were further analyzed using LDA and k-means clustering. Specifically, LDA classified the strategies in the sample into "invest" or "not invest" by finding a discriminant score

[17]ICE stands for Intercontinental Exchange, a financial services company founded in the year 2000. BofA stands for Bank of America, an investment bank and financial services holding company.

that quantified these two categories based on their beta coefficients. By using these techniques, we were able to identify issues with the efficacy of the ratings assigned to investment strategies. Our study could be extended into future directions, such as exploring logistic regression models to analyze the relationship between strategy performance and analyst ratings. Discriminant Analysis could also be applied to create a score that predicts which strategies are most likely to outperform in the future. Additionally, more advanced machine learning models, including neural networks, could be used. For this study, we performed the following steps using Excel's functions.

Preparing the Data in Reports: This process involved reviewing the dataset in 'Reports' to ensure consistency and to check for missing data. Additional columns were added to help locate the word "Rating" in the description of selected portfolios and extracting the rating next to that word. The =FIND("rating", [Cell]) function located "Rating" within the description. To handle missing instances, we used: =IFERROR(FIND("rating", [Cell]), "No Rating Found").

The function =MID([Cell], [Position of Rating] + 7, 1) extracted the rating that follows the word "rating:" The "+7" skips the word "rating" and the colon. IFERROR was again applied to avoid errors, returning "N/A" if no rating was found. The TRIM function was used to remove extra spaces, ensuring that rating values were consistent. The extracted ratings were then converted into numeric values using the VALUE function, which flagged invalid entries.

Creating Dummy Variables: Dummy variables transform categorical data into numerical form so that it can be used in statistical models. For example, to convert "Genre" (e.g., Action, Drama, Comedy) into numeric, for each category, a "Yes/No" variable is created:

- For "Action," the dummy variable is 1 if the genre is Action and 0 otherwise.
- For "Drama," the dummy variable is 1 if the genre is Drama and 0 otherwise.
- For "Comedy," the dummy variable is 1 if Comedy and 0 otherwise.

By using dummy variables, we captured the effect of each category on the variable being studied (e.g., ratings). We created a dummy variable for each rating value, except five stars, as required (e.g., 1, 2, 3, 4). For each column, we used an IF formula to check whether the extracted rating matched a particular number. For a one-star rating by Morningstar: =IF([Rating]=1, 1, 0), etc. We checked to ensure the data was clean and all ratings were correctly extracted and matched to the descriptions. In Excel, the Data Analysis Tool was used to perform all regressions. The Y Range (dependent variable, IR) and X Range (beta coefficients to indices and dummy variables for ratings) were selected. The "Labels" option was ticked. Other necessary options like residuals were checked to ensure homoscedasticity and non-autocorrelation. Table 1 shows part of the data for *IR* predicted at time 0 (current) against betas and dummy variables.

Table 1. *Current Month IR against Betas to Indices and Rating [0,1] Variables*

Portfolios that are 'General Corporate Bond'	alpha	1 Bloomber	11 ICE BofA	15 ICE BofA	20 ICE Bo	8 ICE Bof	10 ICE Bo	12 ICE Bo	5 ICE Bof	1	2	3	4	Curr Mo
JPMorgan Strategic Income Opportunities Fund - R5 (JSOR	0.001	-0.040	-0.237	0.131	0.067	0.216	-0.164	0.143	0.020	-	-	-	1.00	0.659
JPMorgan Strategic Income Opportunities Fund - Select (JS	0.001	-0.035	-0.202	0.067	0.004	0.282	-0.143	0.124	0.017	-	-	1.00	-	0.624
JPMorgan Strategic Income Opportunities Fund - A (JSOAX	0.000	-0.054	-0.199	0.057	0.044	0.262	-0.142	0.125	0.021	-	-	1.00	-	0.462
Dunham Floating Rate Bond Fund - A (DAFRX), Universe:Ge	0.001	-0.174	-0.371	-0.126	0.686	0.215	-0.587	0.735	0.146	-	-	1.00	-	0.284
Dunham Floating Rate Bond Fund - C (DCFRX), Universe:G	0.000	-0.132	-0.432	-0.111	0.796	0.140	-0.609	0.764	0.141	-	1.00	-	-	0.211
Manning & Napier Fund Inc - Core Plus Bond Series Fund -	0.003	0.311	-1.850	2.497	0.756	-0.880	-0.098	0.025	0.121	-	-	-	1.00	0.196
JPMorgan Strategic Income Opportunities Fund - C (JSOCX	0.000	-0.060	-0.219	0.070	0.098	0.229	-0.143	0.131	0.019	-	-	1.00	-	0.177
Western Asset SMASh Series C Fund - C (LMLCX), Univers	-0.001	-0.318	0.949	-2.503	0.492	1.434	0.297	0.326	-0.094	-	-	-	-	0.038
Columbia Income Opportunities Fund - Y (CIOYX), Universe	0.000	0.024	-0.604	0.719	1.039	-0.912	0.187	0.652	0.083	-	-	1.00	-	0.025
Columbia Income Opportunities Fund - R5 (CEPRX), Univer	0.000	0.026	-0.522	0.668	0.876	-0.819	0.205	0.656	0.068	-	-	1.00	-	0.012
Columbia Income Opportunities Fund - R4 (CPPRX), Univer	0.000	0.017	-0.611	0.723	1.059	-0.926	0.194	0.657	0.081	-	-	1.00	-	0.008

Analysis and Results

We sought the simplest statistical model that an organization with fiduciary responsibility could implement, to address the efficacy of advice in the form of portfolio strategy ratings [r] in (1), based on variables created through a process that follows the methodology above. The linear regression with dummy variables technique was promulgated by (i) the availability of statistical analysis methods in Excel, and/or (ii) the desire to create as simple a starting model as possible to help address pressure from regulators regarding the access to legal avenues by the institutional investor through the Department of Labor's Fiduciary Rule. The equation is given below.

$$IR(p, t+j) = b_0 + \sum_{i=1}^{8} b_{i,j}\beta_{i,p} + \sum_{r=1}^{4} d_{i,j}\mathbb{I}_{[r],p} + \varepsilon \qquad (1)$$

$IR(p, t+j)$ = estimated information ratio j months ahead, j = 0, 6, 12, 23 months.
$b_{i,j}$ = regression coefficient of IR(p, $t+j$) against beta for index i = 1, 2, 3, …, 8.
$\beta_{i,p}$ = estimated beta of portfolio p's IR against index i (Rolling Regression)
$d_{i,j}$ = regression coefficient of IR(p, $t+j$) against rating-r-indicator $\mathbb{I}_{[r],p}$.
$\mathbb{I}_{[r],p}$ = indicator variable for Morningstar rating r = one, two, three or four stars.

For example, the first investment strategy in Table 1 above has the label:

p = JPMorgan Strategic Income Opportunities Fund - R5 (JSORX), Universe: General Corporate Bond, Rating:4 Stars Low, Unconstrained: N, Count:59
Equation (1) applies to JPMorgan Strategic Income Opportunities as follows:

$$IR(JPMorgan, t+0) = b_0 + b_{1,0}(-0.040) + b_{2,0}(-0.237) + b_{3,0}(0.131) + b_{4,0}(0.067) + b_{5,0}(0.216) + b_{6,0}(-0.164) + b_{7,0}(0.143) + b_{8,0}(0.020) + +d_{1,0}(0) + d_{2,0}(0) + d_{3,0}(0) + d_{4,0}(1) + \varepsilon \qquad (2)$$

Table 2. *Regression Coefficients of IR against Betas and Dummy Variables*

	j = Current Month	j = Six Months Forward	j = Twelve Months Forward	j = Twenty Four Months Forward
	Coefficients	*Coefficients*	*Coefficients*	*Coefficients*
Intercept	0.432	0.566	0.322	-4.762
Bloomberg Global Aggregate Bond (LEGATRUU)	-0.052	-0.325	-1.286	-1.555
ICE BofA AAA US Corporate Index (BAMLCC0A1AAATRIV)	**-0.813**	**-1.111**	**-1.957**	**3.079**
ICE BofA AA US Corporate Index (BAMLCC0A2AATRIV)	**-1.075**	**-1.332**	**-1.668**	**4.590**
ICE BofA Single-A US Corporate Index (BAMLCC0A3ATRIV)	**-0.504**	**-0.560**	**-0.911**	**5.756**
ICE BofA BBB US Corporate Index (BAMLCC0A4BBBTRIV)	**-1.297**	**-1.652**	**-1.380**	**6.608**
ICE BofA BB US High Yield Index (BAMLHYH0A1BBTRIV)	**-1.232**	**-1.972**	**-2.130**	**4.783**
ICE BofA Single-B US High Yield Index (BAMLHYH0A2BTRIV)	**-0.607**	**-0.649**	-0.782	9.016
ICE BofA CCC & Lower US High Yield Index (BAMLHYH0A3CMTRIV)	**-3.940**	**-6.265**	**-8.350**	**-6.175**
Morningstar Rating = One Star, d_1	**1.713**	**2.257**	2.673	-1.826
Morningstar Rating = Two Stars, d_2	0.094	-0.134	**0.883**	**-2.094**
Morningstar Rating = Three Stars, d_3	0.201	0.091	0.748	-1.802
Morningstar Rating = Four Stars, d_4	**0.347**	0.282	0.718	-1.580

Table 3. *Statistical Significance of IR against Betas and Dummy Variables*

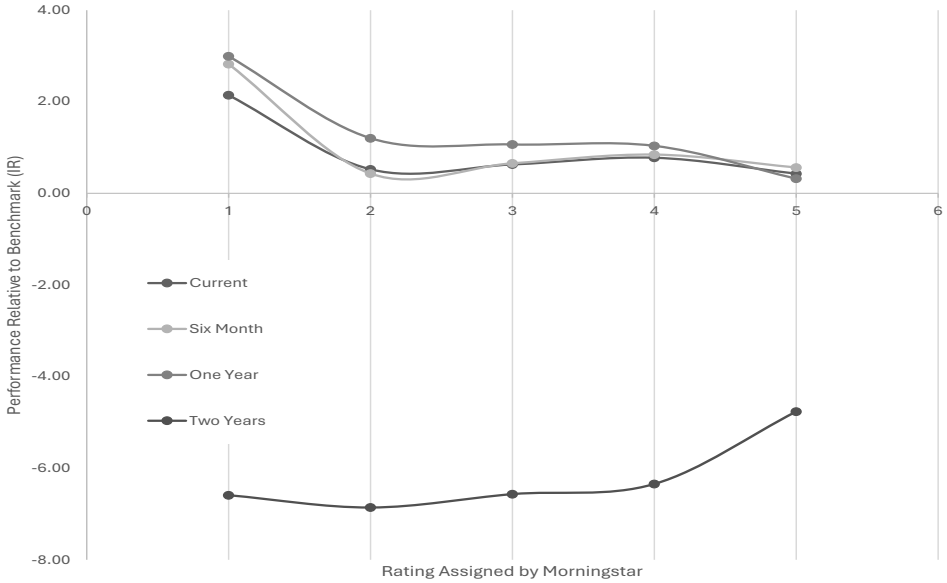
	j = Current Month	j = Six Months Forward	j = Twelve Months Forward	j = Twenty Four Months Forward
	P-value	*P-value*	*P-value*	*P-value*
Intercept	0.055	0.050	0.595	0.595
Bloomberg Global Aggregate Bond (LEGATRUU)	0.823	0.280	0.056	0.056
ICE BofA AAA US Corporate Index (BAMLCC0A1AAATRIV)	**0.008**	**0.005**	**0.020**	**0.020**
ICE BofA AA US Corporate Index (BAMLCC0A2AATRIV)	**0.000**	**0.000**	**0.028**	**0.028**
ICE BofA Single-A US Corporate Index (BAMLCC0A3ATRIV)	**0.007**	**0.018**	**0.070**	**0.070**
ICE BofA BBB US Corporate Index (BAMLCC0A4BBBTRIV)	**0.000**	**0.000**	**0.087**	**0.087**
ICE BofA BB US High Yield Index (BAMLHYH0A1BBTRIV)	**0.000**	**0.000**	**0.002**	**0.002**
ICE BofA Single-B US High Yield Index (BAMLHYH0A2BTRIV)	**0.016**	**0.041**	0.244	0.244
ICE BofA CCC & Lower US High Yield Index (BAMLHYH0A3CMTRIV)	**0.001**	**0.000**	**0.008**	**0.008**
Morningstar Rating = One Star, d_1	**0.008**	**0.006**	0.117	0.117
Morningstar Rating = Two Stars, d_2	0.541	0.497	**0.047**	**0.047**
Morningstar Rating = Three Stars, d_3	0.190	0.636	0.084	0.084
Morningstar Rating = Four Stars, d_4	**0.021**	0.130	0.079	0.079

Ratings and Outperformance are Inversely Related

The reader might have expected that the dummy variable coefficients in Table 2 above would be ranked in magnitude as $d_1 < d_2 < d_3 < d_4$. In other words, the dummy variable $\mathbb{I}_{[r=4],p}$ that is for strategies rated as four-stars, would add to the Information Ratio more than what dummy variable $\mathbb{I}_{[r=3],p}$ did, which would add more than $\mathbb{I}_{[r=2],p}$, which would add more than $\mathbb{I}_{[r=1],p}$ did. But, that does not happen here, which poses some doubt on the efficacy of this rating system. The diagram below shows that the best alternative available to the institutional investor, with access to such portfolio ratings, is the group rated the lowest, by at least this investment consultant. There is a pronounced negative relation between ratings and the addition to *IR* of each rating, for j = 0, 6 and 12 months. This relationship might be of concern to institutional investors, although an outright breach of fiduciary responsibility cannot and should not be concluded based on

this data. The reasons are that (i) there is often a lag between the time an analyst/ consultant looks at the materials related to due diligence of a strategy and that of assigning a rating, and (ii) in the time it takes for a rating to be assigned, a strategy rated high may underperform due to just the change in the business cycle. For example, an Inflation-Linked strategy may have exposure to short-duration credit yields while anticipating inflationary episodes, in contrast to a 'pure play' in this universe. It might be rated four stars. By the time such rating is entered, short-term spreads may widen, resulting in underperformance. Thus, ratings and outperformance may appear to have an inverse relation, contrary to common sense. The vertical axis in Figure 1 below shows the intercept plus addition to Information Ratio (IR or Relative Performance, risk adjusted) for each of the ratings one-, two-, three- and four-stars (the rating of five-stars is incorporated into the intercept as standard dummy-variable estimation requires). For example, the intercept b_0 plus the addition to current month IR attributed to rating one-star is 0.432 + 1.713 = 2.145. The same figures for 6-month and 12-month IR are 0.556 + 2.257 = 2.824 and 0.322 + 2.693 = 2.995, shown as starting points of the lines in the top panel of Figure 1, which pertains to IR for current, a six-month, and twelve-month forward projection. From that point as we move forward to ratings 2 (two-star), 3 (three-star) and 4 (four-star), information ratio declines, not because the intercept b_0 changes, but because the contribution to IR from each rating declines. For an allocation horizon of zero, six, and twelve months forward, the institutional investor should have invested the funds managed into portfolio strategies that are rated the lowest, by Morningstar. That may cause worry, not necessarily from the perspective of intentional breach of fiduciary duty, but as stemming from time inefficiencies or other hidden biases faced by the advisor/ consultant assigning the rating. As mentioned above, the precise reasons for the patterns found is beyond the scope of this study.

Figure 1. *Addition to Relative Performance by Rating, Current and Projected*

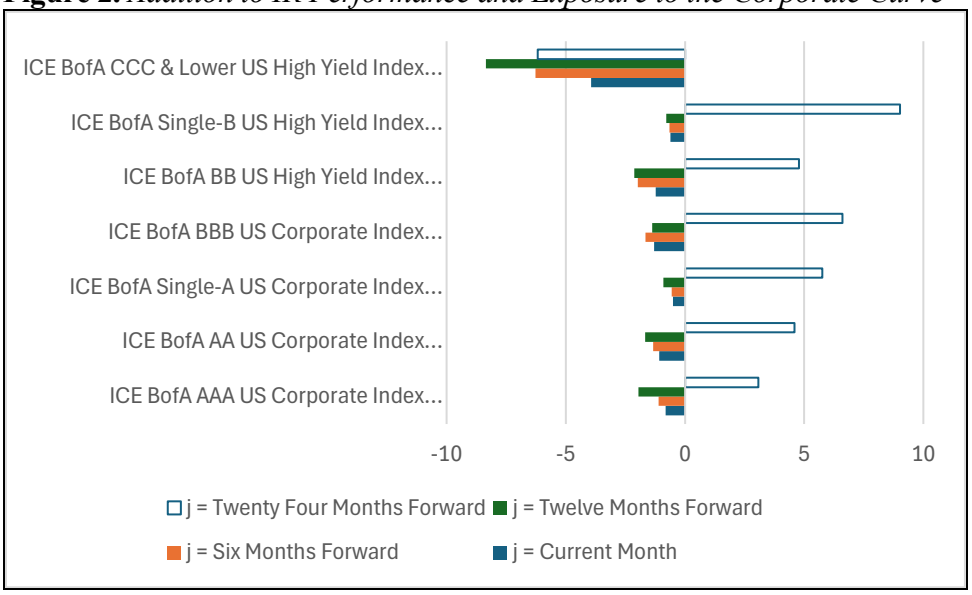


The fourth line in Figure 1 reveals the projected impact of the business cycle on portfolio strategy performance. Specifically, investment managers produce negative 'alpha' two years hence. A business cycle in the U.S. may last two years, and investment strategies that worked at the start will underperform if not pivoted on time. The autoregressive model that we use captures this non-pivoted relation of IR against beta coefficients and the rating-dummy variables. The bottom panel of Figure 1 shows that, if strategy betas to indices remain the same, IR in two years will be around the -6.5 or less region (a healthy information ratio should range around positive 2.0 and above). It may be the case that consulting firms often claim that their ratings represent outperformance through the whole business cycle, and/or for two years into the future. Given the fact that, based on our estimates a strategy that has not pivoted in time will underperform in two years, might such claims be less than accurate, if not properly tested statistically? The bottom panel of Figure 1 shows that, given the already negative b_0 = -4.762 that applies across all ratings, performance two years hence for one-, two-, three-, and four-star ratings is -6.589, -6.857, -6.564 and -6.343, respectively, if strategies did not change their allocation schemes by that time. One would have to presume that the due diligence process engaged in by Morningstar evaluates future pivoting, and/or portfolio managers voluntarily disclose such plans and then follow them exactly. The only conclusion one can discern from the results is that ratings and outperformance align two years into the future, albeit in negative territory, with the four-star rating subtracting the least (b_0 – 1.580) from information ratio for non-pivoted strategies. Unless consultants gauge and rigorously evaluate such pivoting plans by the portfolio manager, any claim that ratings capture performance two years into the future, might be hard to properly support or prove.

The statistically significant coefficients for the seven ICE BofA indices from Table 2, above, show that the credit curve captured by these indices subtracts from performance for zero, six, and twelve months forth, and adds to performance for two years forward, apart from CCC exposure, assuming no pivoting of strategy before the presumed change in the business cycle. This part makes the relation of ratings to performance more complicated. It seems that, without pivoting, the markets will carry performance in the absence of manager skill (b_0) two years into the future.

ICE BofA AAA US Corporate Index (BAMLCC0A1AAATRIV)
ICE BofA AA US Corporate Index (BAMLCC0A2AATRIV)
ICE BofA Single-A US Corporate Index (BAMLCC0A3ATRIV)
ICE BofA BBB US Corporate Index (BAMLCC0A4BBBTRIV)
ICE BofA BB US High Yield Index (BAMLHYH0A1BBTRIV)
ICE BofA Single-B US High Yield Index (BAMLHYH0A2BTRIV)
ICE BofA CCC & Lower US High Yield Index (BAMLHYH0A3CMTRIV)

Figure 2. *Addition to IR Performance and Exposure to the Corporate Curve*



Linear discriminant analysis (LDA) is carried out to reveal the relation between Information Ratio and recommendation of an investment strategy to the institutional investor based on ratings. The ratings comprise categorical data and thus are hard to compare to quantitative performance; unless ratings were changed to a quantitative score, achieved through linear discriminant analysis (LDA). The goal of ratings is to help the institutional client reach some binary decision of 'invest' or 'not invest' upon looking at them, in its simplest form. We make an arbitrary but not so far-fetched assumption that the representative plan sponsor of an institutional account will consider investment portfolios rated four-stars and above, as fund allocation candidates. For all of the four 'forward-looking' versions of our IR model (zero, six, twelve and two years) we follow the steps below in devising the linear discriminant score, which is now quantitative.[18] According to Fisher (1936), the linear discriminant score is $X_p = \sum_{i=1}^{8} \lambda_i \beta_{i,p}$ with $\beta_{i,p}$ the same as in (1).

a) We separated the strategies into one group rated four-stars and above (and thus it has portfolios that are recommended to the institutional client), and one below four-star (and thus not recommended) by Morningstar. We found the average for each of the indices. For example, for IR in the current month, the average beta coefficients for recommended and not recommended strategies were as shown below:

[18]This methodology exactly replicates the original work by Fisher 1936. *The Use of Multiple Measurements in Taxonomic Problems.*

	Bloomberg Global Aggregate Bond (LEGATRUU)	ICE BofA AAA US Corporate Index (BAMLCC0A1AAATRIV)	ICE BofA AA US Corporate Index (BAMLCC0A2AATRIV)	ICE BofA Single-A US Corporate Index (BAMLCC0A3ATRIV)	ICE BofA BBB US Corporate Index (BAMLCC0A4BBBTRIV)	ICE BofA BB US High Yield Index (BAMLHYH0A1BBTRIV)	ICE BofA Single-B US High Yield Index (BAMLHYH0A2BTRIV)	ICE BofA CCC & Lower US High Yield Index (BAMLHYH0A3CMTRIV)
Recommended	-0.266	-0.696	0.486	1.546	-0.371	0.158	-0.129	0.137
Not Recommended	-0.088	-0.561	0.624	0.940	-0.305	0.072	0.163	0.095

b) For each beta coefficient to an index, we found the square of differences d_i of the means, weighted by λ_i, between recommended and not recommended: $D^2 = \left\{\sum_{i=1}^{8} \lambda_i \beta_{i,p}\right\}^2$

c) For the $\beta_{i,p}$ coefficients of the strategies recommended, we found their difference from their individual means, $\left[\beta_{1,p} - \overline{\beta_{1,p}}, \beta_{2,p} - \overline{\beta_{2,p}}, \ldots, \beta_{8,p} - \overline{\beta_{8,p}}\right]$ for each portfolio, p. We multiplied that vector by its transpose to get the terms of the covariance matrix, S_{pq}^2.

d) We pre-multiplied and post-multiplied S_{pq}^2 by vector λ_i, to get $S^2 = \sum_{p=1}^{8} \sum_{q=1}^{8} \lambda_p \lambda_q S_{pq}$.

e) To arrive at X_p, we used solver.xla in Excel to maximize the ratio D^2/S^2 with respect to the 'weights' of the discriminant score, λ_i. The resulting discriminant function score was:

$$X_p = \sum_{i=1}^{8} \lambda_i \beta_{i,p} = 1.00\beta_{1,p} - 1.89\beta_{2,p} - 0.87\beta_{3,p} + 0.83\beta_{4,p}$$
$$+0.40\beta_{5,p} - 0.68\beta_{6,p} - 0.85\beta_{7,p} - 5.94\beta_{8,p}$$

The average score of the strategies recommended based on a Morningstar score of four-star and above was 0.95, and that for strategies not recommended was -23.53. But their standard deviations were 0.31 and 33.08, respectively. Why was the standard deviation of strategies not recommended, so wide? These score values did not change between the IR models (zero, six, twelve and two years) because they were based only on the beta coefficients, which were the same for all four versions. Changing the star categories to a recommendation score allowed for a comparison between quantified recommendation and IR performance, in zero, six, twelve and two years, shown in the two diagrams below (the diagrams for six- and twelve-months forward were like current month and are thus not shown). We observe in figure 3 that the strategies not recommended fall very wide to the right and the left of those recommended. In other words, there are investment strategies to the right of the 0.95 score which have an exceedingly high recommendation score and would thus have received a four- or five-star by Morningstar; but which perform dismally. Two years forward, that performance disappears. We would have expected a continuous positive relation between discriminant score and IR. That does not happen. Further analysis with data is needed here to discern the patterns of mismatch between IR and the discriminant function score that implies recommendation for investment based on ratings.

Figure 3. *IR for the Current Month against Recommendation Discriminant Score*

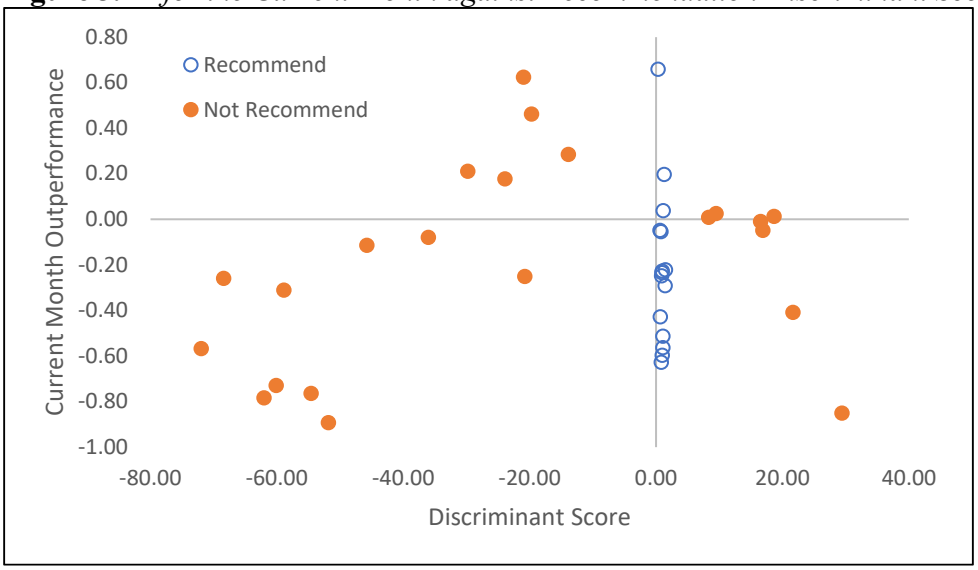
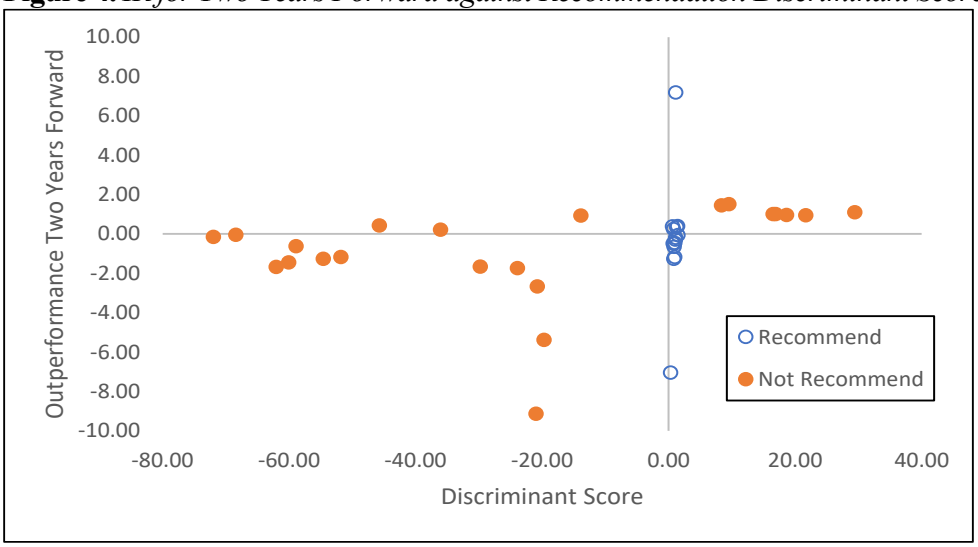


Figure 4. *IR for Two Years Forward against Recommendation Discriminant Score*



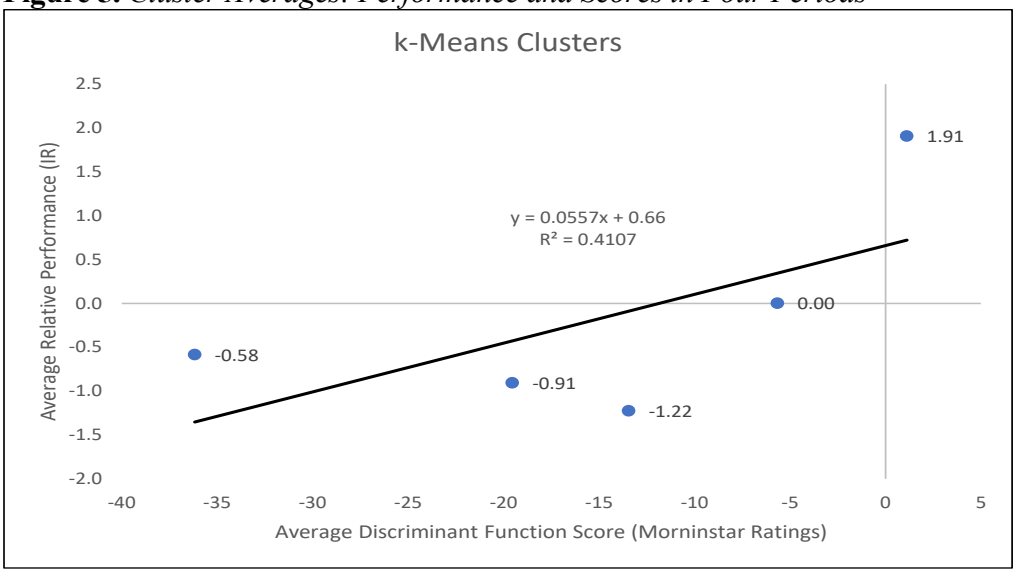
Given that ratings do not efficaciously segregate strategy performance relative to a benchmark, a question that naturally arises is, do portfolios segregate in clusters that show a vague relation between ratings and performance by themselves? Does the discriminant score of recommendation based on ratings bear any semblance to average performance over current month, and six-, twelve month and to years forward? We ran a k-means clustering algorithm in RStudio, with five clusters (since Morningstar has five-star ratings) of all four measures of performance (current, six months, twelve months, two years). We wanted to see if the four measures of IR performance would somehow group by themselves, into unsupervised clusters that would align with an average discriminant score for recommendation. The results in Table 4 were optimistic but with great variation. Based on risk-adjusted fund performance (IR), cluster one, for example, shows a recommendation score that varies widely from -62.06 to 0.96 with an average of -19.54 and average performance over

four periods of -0.91. The same numbers for the second cluster are -5.66 and 0.00; for the next cluster -36.17 and -0.58, etc. Figure 5 shows that there may be a positive relation between ratings and performance, albeit a very vague one. The average discriminant function score in a cluster of four-period performance weakly aligns with average performance across strategies and periods in the same cluster. The linear relation has an R-Square of only 41.07% which is high given the degrees of freedom. Unfortunately, the range of Recommend scores in each cluster are too wide to justify a level of confidence that the recommendations resulting from Morningstar ratings and the risk-adjusted performance across time have a fund-by-fund correspondence that the institutional investor could semi-blindly rely on. In clusters 1 and 2, which contain most portfolios, we would expect ratings to be such that the Recommend score gravitated around -19.54 and -5.66, respectively.

Table 4. *Clusters of Performance Recommendation Scores in Four Periods*

Portfolio	Cluster	Recommend	Curr Mo	6 Mo(s) Fwd	12 Mo(s) Fwd	23 Mo(s) Fwd	Average
AllianceBernstein Corporate Income Shares (ACISX)	1	-62.06	-0.78	-1.33	-2.25	-1.67	
BNY Mellon Corporate Bond Fund - Investor (BYMIX)	1	-60.10	-0.73	-1.23	-1.49	-1.45	
BNY Mellon Corporate Bond Fund - M (BYMMX)	1	-58.90	-0.31	-0.69	-0.79	-0.62	
Columbia Corporate Income Fund - R4 (CIFRX)	1	0.68	-0.43	-0.34	-1.96	-0.48	
Columbia Corporate Income Fund - R5 (CPIRX)	1	0.82	-0.63	-1.16	-2.19	-1.26	
Columbia Corporate Income Fund - Y (CRIYX)	1	0.84	-0.25	-0.64	-0.74	-0.65	
Invesco Corporate Bond Fund - A (ACCBX)	1	0.92	-0.23	-0.59	-0.52	-0.49	
Invesco Corporate Bond Fund - R5 (ACCWX)	1	0.95	-0.23	-0.60	-0.61	-0.46	
JPMorgan Corporate Bond Fund - R6 (CBFVX)	1	0.96	-0.60	-1.12	-1.90	-1.16	
	Cluster 1	-19.54	-0.47	-0.85	-1.38	-0.92	-0.91
JPMorgan Corporate Bond Fund - Select (CBFSX)	2	-71.99	-0.57	-0.69	-0.25	-0.15	
JPMorgan Strategic Income Opportunities Fund - R5 (JSORX)	2	-68.43	-0.26	-0.61	-0.48	-0.04	
MainStay Indexed Bond Fund - A (MIXAX)	2	-45.75	-0.11	-0.18	-0.28	0.43	
MainStay Indexed Bond Fund - I (MIXIX)	2	-36.05	-0.08	-0.13	-0.24	0.21	
Manning & Napier Fund Inc - Core Plus Bond Series - I (MNCPX)	2	-13.90	0.28	0.44	1.00	0.94	
Western Asset SMASh Series C Fund - C (LMLCX)	2	0.61	-0.05	-0.09	-0.25	0.38	
American Funds Corporate Bond Fund - 529C (COBCX)	2	0.75	-0.06	-0.15	-0.28	0.24	
Columbia Corporate Income Fund - A (LIIAX)	2	1.05	-0.51	-0.67	-0.25	-0.29	
Columbia Corporate Income Fund - C (CIOCX)	2	1.09	-0.56	-0.69	-0.27	-0.20	
Columbia Income Opportunities Fund - R (CIORX)	2	1.25	0.20	0.27	0.04	0.36	
Columbia Income Opportunities Fund - R4 (CPPRX)	2	1.43	-0.29	-0.17	-0.22	0.40	
Columbia Income Opportunities Fund - R5 (CEPRX)	2	1.45	-0.22	-0.09	-0.51	-0.06	
Columbia Income Opportunities Fund - Y (CIOYX)	2	8.33	0.01	-0.08	-0.23	1.45	
Columbia Income Opportunities Fund - Z (CIOZX)	2	9.51	0.03	-0.09	-0.25	1.52	
Dunham Floating Rate Bond Fund - A (DAFRX)	2	16.52	-0.01	-0.08	-0.21	1.01	
Dunham Floating Rate Bond Fund - C (DCFRX)	2	16.90	-0.05	-0.09	-0.21	1.00	
Invesco Corporate Bond Fund - C (ACCEX)	2	18.64	0.01	-0.03	-0.21	0.96	
Invesco Corporate Bond Fund - R (ACCZX)	2	21.66	-0.41	-0.38	0.34	0.95	
JPMorgan Corporate Bond Fund - A (CBRAX)	2	29.41	-0.16	-0.23	-0.22	0.43	
	Cluster 2	-5.66	-0.15	-0.19	-0.16	0.50	0.00
JPMorgan Corporate Bond Fund - C (CBRCX)	3	-54.58	-0.76	-1.42	0.13	-1.26	
JPMorgan Strategic Income Opportunities Fund - A (JSOAX)	3	-51.83	-0.89	-1.47	0.09	-1.17	
JPMorgan Strategic Income Opportunities Fund - C (JSOCX)	3	-29.81	0.21	0.13	1.21	-1.65	
JPMorgan Strategic Income Opportunities Fund - Select (JSOSX)	3	-23.90	0.18	0.16	0.26	-1.73	
MainStay Indexed Bond Fund - INV (MIXNX)	3	-20.75	-0.25	-0.41	-0.35	-2.67	
	Cluster 3	-36.17	-0.30	-0.60	0.27	-1.70	-0.58
Western Asset Corporate Bond Fund - C (LWBOX)	Cluster 4	1.12	0.04	0.11	0.30	7.18	1.91
Western Asset Corporate Bond Fund - P (LCBPX)	5	-20.97	0.62	0.69	1.02	-9.13	
Western Asset SMASh Series EC Fund - EC (LMECX)	5	-19.69	0.46	0.44	1.01	-5.38	
Western Asset SMASh Series M Fund - M (LMSMX)	5	0.31	0.66	0.63	1.32	-7.04	
	Cluster 5	-13.45	0.58	0.59	1.12	-7.18	-1.22

Figure 5. *Cluster Averages: Performance and Scores in Four Periods*



Conclusion

In this study, we investigate the role of investment advising and portfolio recommendations made by consulting firms such as Morningstar to institutional clients. A key concern in the context of U.S. regulatory bodies is the issue of breach of fiduciary duty, where advisers encourage portfolio managers to offer monetary benefits in exchange for favorable ratings of their investment strategies. Although we did not find any robust correspondence between ratings and relative performance, we would be hard-pressed to conclude that Morningstar, or any other investment advisor for that matter, is abrogating fiduciary responsibility. Having said that, we examined a list of statistical models that could be used as quality control methodologies of rating efficacy.

Investment advising/consulting firms play a central role in determining the allocation of retiree funds into investment strategies. In this study, generally accepted metrics in active management help assess the efficacy of information produced by Morningstar, in its role as portfolio evaluator and issuer of one-to-five-star ratings. We use the betas against eight indices representing the credit yield curve, as the x-variables and regress them against IR. Portfolio managers decide to buy and sell assets at the various parts of the yield curve. The assigned ratings should not deviate materially from the active outperformance generated here as Information Ratio (IR). Quantitative methods allow institutional investors to systematically classify strategies based on performance irrespective of the ratings assigned to strategies. Finance implements clustering algorithms such as k-Means and classification techniques like Linear Discriminant Analysis (LDA) as approaches for identifying hidden patterns in optimal investment portfolio selection. Using such methods we find that investment performance of strategies rated, and the ratings themselves, do not align. For example, the regression dummy variable for the least favorable Morningstar rating adds the most to the risk-adjusted outperformance (Information Ratio, IR), leading to the easy,

'arbitrage' process of simply allocating retiree funds to the lowest-rated portfolios. Discriminant function scores, on the other hand, span all over the performance range for both recommended and not recommended strategies. Several highly recommended strategies based on Morningstar ratings produce dismal risk-adjusted performance. For the five clusters identified based on outperformance of the current month, six-months forward, 12-months forward and two years forward, combined, risk-adjusted performance is positively related to the linear discriminant score of recommendation based on ratings in very general terms; obscuring the other negative relations between ratings and outperformance obtained in other methods. The results of this study may be of interest in the regulatory arena of fiduciary responsibility, a full legal analysis of which is out-of-scope for this study.

Ratings and outperformance inversely relate because of the business cycle or an assessment-to-rating time gap and are not necessarily due to intentional breach of fiduciary duty. Ratings mildly align with risk-adjusted outperformance two years forward, but that is not enough for consultants to claim that their rating process is 'forward looking' as investment managers consistently produce negative alpha two years hence, irrespective of rating. The relation between consultant ratings and risk-adjusted performance of rated strategies is obscure. Recommended strategies for investment, at the very least, fail to exhibit performance that is higher than strategies not recommended. Highly recommended strategies exhibit significant underperformance across all kinds of time intervals. There appears to be only an imprecise, vague positive relation between clusters of performance and ratings. Still, our analysis cannot suggest that the issue of pay-to-play appears to manifest significantly in the ratings provided by investment consultants like Morningstar. The methods of k-means clustering and LDA isolated patterns of disconnect between ratings and relative outperformance, in this application of finance. Further study is required in this area, to precisely pinpoint the areas where investment consultants who assign ratings miss it as far as the future outperformance of strategies rated exceedingly high is concerned. The institutional investor cannot rely solely on ratings to select investment strategies in which the beneficiaries' funds can be allocated. The use of statistical models will augment that process if appropriately used.

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Beyond Borders: Leadership and Grit in the Lives of Migrant Teachers

By Lize van Hoek[*] & Shalane Ottö[±]

Growing teacher mobility has expanded the international school sector, creating a diverse workforce of migrant educators who often navigate unfamiliar cultural, professional, and organisational environments. This study investigates how perceived school leadership influences the grit and job satisfaction of international migrant teachers, and whether grit serves as a mediating mechanism in this relationship. Drawing on the Human Relations perspective, which emphasises the role of supportive social contexts in fostering motivation and well-being, the study employed an exploratory quantitative design. Data were collected from 103 migrant teachers working across multiple international school systems using validated measures of leadership, grit, and job satisfaction. Correlation and mediation analyses revealed that supportive leadership was positively associated with both grit and job satisfaction. Grit partially mediated the leadership-job satisfaction link, indicating that leadership not only improves workplace satisfaction directly but also does so indirectly by strengthening teachers' perseverance and commitment to long-term goals. These findings highlight the importance of relational, inclusive leadership practices in fostering resilience and fulfilment among globally mobile educators. The study provides theoretical and practical insights for international schools aiming to improve teacher well-being, motivation, and retention.

Keywords: *international migrant teacher, grit, job satisfaction, human relations theory, international schools, leadership*

Introduction

Teacher mobility has expanded the international school sector, creating a growing population of migrant teachers who work across diverse national and cultural contexts. International school systems are educational institutions that offer globally recognised curricula—such as the International Baccalaureate (IB), Cambridge International Examinations, or American/UK-based programmes—and employ a multinational teaching staff while serving culturally diverse student bodies (Bunnell 2019, Lee and Park 2025). Migrant teachers bring valuable pedagogical expertise to host schools but also face transition-related challenges, such as cultural adjustment, differences in professional accreditation, and pedagogical reorientation, which can impact their retention and performance (Ennerberg and Economou 2021, Mizzi 2021).

At the same time, school leadership has been repeatedly linked to teacher outcomes such as motivation, job satisfaction, and retention (Grissom et al. 2021). However, less is known about how leadership influences non-cognitive traits such as

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grit—defined by Duckworth et al. (2007) as perseverance and passion for long-term goals—and how these traits, in turn, affect job satisfaction among migrant teachers working in international school contexts.

This paper, therefore, investigates the perceived influence of school leadership on teachers' grit and job satisfaction in international school settings and examines whether grit mediates the relationship between leadership and job satisfaction. This approach is consistent with leadership literature that views leaders as contextual actors who shape the climate, support, and working conditions that influence individual differences and attitudes. The study employs an exploratory quantitative design to investigate the perceived relationships among leadership, grit, and job satisfaction in a global sample of international migrant teachers.

The aim of this study is to determine the perceived influence of school leadership on (a) grit and (b) job satisfaction of international migrant teachers, and (c) whether grit mediates the relationship between leadership and job satisfaction. The paper is structured as follows: the first section provides the introduction, outlining the background, research problem, and aims of the study. The second section presents an up-to-date literature review, drawing on recent theoretical and empirical studies that inform the conceptual framework. The third section explains the research methodology and presents the findings of the quantitative analysis. The fourth section offers a discussion of the results in relation to existing literature and practical implications. Finally, the last section concludes the paper by summarising the main findings, highlighting contributions to the field, and providing recommendations for future research.

Literature Review

Theoretical Framework: The Human Relations Perspective

This study draws on Elton Mayo's Human Relations perspective (Mayo 1953) as its central theoretical framework. Mayo's work shifted organisational thought from mechanistic models to an appreciation of the social and psychological dimensions of work. The theory emphasises that attention to employee needs, supportive interpersonal relationships, recognition, and opportunities for participation strongly influence motivation, satisfaction, and performance. Within this framework, leadership is conceptualised as a social process that shapes the immediate work environment through communication, support, trust, and vision.

Applying this perspective to education, school leaders act as contextual agents who create environments that foster a sense of belonging, psychosocial safety, and professional growth. These conditions not only promote teacher satisfaction but may also strengthen persistence and passion toward long-term professional goals—qualities aligned with the construct of grit. Thus, the Human Relations approach supports examining leadership as the contextual factor (X) that influences individual motivation and outcomes, with grit as a mediating mechanism (M) and job satisfaction as the dependent variable (Y).

This framework has gained renewed relevance in educational research, which links supportive leadership with teacher motivation, resilience, and retention (Kaya et al.

2024, He 2023). It provides a coherent lens through which to interpret how leadership behaviours foster psychological resources such as grit and, in turn, shape job satisfaction— especially within multicultural and international school environments.

Migration and International School Contexts

Teacher mobility has expanded significantly in recent decades, leading to a growing workforce of migrant educators employed in international school systems. These schools typically serve multinational student bodies and follow globally recognised curricula, such as the International Baccalaureate (IB) or Cambridge International Examinations (Bunnell 2019, Lee and Park 2025).

While international teachers contribute diverse pedagogical and cultural knowledge, they often face professional and social challenges, including differences in accreditation, teaching standards, and cultural adaptation (Ennerberg and Economou 2021, Mizzi 2021). Derrah (2024) highlights that school-level support—such as mentorship and inclusive leadership—plays a pivotal role in helping migrant teachers integrate successfully and maintain job satisfaction.

Within Mayo's Human Relations framework, leadership that recognises teachers' emotional and social needs can mitigate the stressors of migration and adjustment. Leadership in international schools thus becomes not only an administrative function but also a relational and cultural practice that influences teacher motivation, resilience, and retention (Manogaran and Abdul-Wahab 2024).

Grit in Educational Contexts

Grit, defined as perseverance and passion for long-term goals (Duckworth et al. 2007), has gained prominence as a non-cognitive predictor of success in education. Empirical studies have linked teacher grit to persistence, professional resilience, and well-being (He 2023, Zhang 2023). Teachers with higher grit levels tend to demonstrate greater emotional stability and satisfaction, even in challenging conditions (Ismail 2023, Lee 2024).

However, research focusing on grit among international or migrant teachers remains limited. Most existing studies examine grit among pre-service or English as a Foreign Language teachers in domestic contexts (Fan et al. 2024, Yang 2024). This gap underscores the need for exploratory quantitative studies that examine how leadership climates in international schools influence grit, and in turn, impact job satisfaction and retention.

Integrating grit into leadership research offers a deeper understanding of how contextual and personal factors interact to shape teacher outcomes.

Leadership and Teacher Outcomes

School leadership is one of the most consistent predictors of teacher motivation, job satisfaction, and retention. Transformational and supportive leadership styles that prioritise communication, trust, and professional growth are associated with higher engagement and lower turnover (Grissom et al. 2021, Kaya et al. 2024).

In international schools, the importance of leadership is amplified due to cultural and curricular diversity. Leaders who articulate a clear vision, offer professional development, and demonstrate cultural sensitivity foster a sense of inclusion and belonging among migrant staff (Derrah 2024). This relational view of leadership echoes Mayo's premise that the quality of interpersonal relations and emotional support is central to organisational effectiveness.

Leadership, therefore, functions both as a contextual factor shaping teachers' immediate experiences and as a mechanism that cultivates psychological resources such as grit.

Interplay between Leadership, Grit, and Job Satisfaction

Emerging evidence suggests that leadership can influence non-cognitive attributes such as persistence, resilience, and grit. Supportive leadership has been shown to cultivate perseverance and optimism by fostering emotionally safe and motivating environments (Rego et al. 2021, Caza and Posner 2019). Grit, in turn, has been positively linked to job satisfaction across various teacher populations (Gustari and Widodo 2021).

Synthesising these strands, the conceptual model guiding this study posits that leadership directly enhances job satisfaction while also indirectly influencing it through its effect on grit. In this framework, grit operates as a mediating mechanism that channels the positive effects of leadership into greater motivation and professional fulfilment.

This integrated view aligns with the Human Relations theory and contributes new insights by examining these relationships within the underexplored context of international migrant teachers in global school systems.

Research Methodology

This study adopted an explanatory quantitative research design within a positivist paradigm. The positivist approach assumes that relationships between variables can be observed and measured objectively through empirical data (Creswell and Creswell 2023). The explanatory design was chosen because the study sought to examine the predictive and mediating relationships among measurable constructs—perceived leadership, grit, and job satisfaction—rather than exploring subjective meanings or lived experiences. Quantitative designs are appropriate when testing theoretical models and analysing the strength and direction of relationships between variables using statistical techniques (Saunders et al. 2019, Adams and Lawrence 2021).

This design aligns with the study's conceptual framework, which posits that perceived leadership (independent variable) influences grit (mediator), which in turn influences job satisfaction (dependent variable).

Study Population and Sample

The study population comprised international migrant teachers currently employed at international schools across various countries. These teachers were selected because they work in multicultural educational environments that heavily depend on leadership quality to support professional and personal growth. A homogeneous purposive sampling strategy was used to identify participants who share the defining characteristic of being international migrant teachers (Palinkas et al. 2015). Data were collected online through a structured questionnaire distributed via professional networks, educational platforms, and social media groups for international educators. The sample size was determined using the G*Power 3.1 statistical tool to ensure adequate statistical power (Faul et al. 2009). A minimum of 150 responses was required to detect medium effect sizes at a power level of 0.80 an $\alpha = 0.05$.

Data Collection Instruments

Data were collected using an online questionnaire consisting of four sections: demographic information and three validated measurement scales. Perceived Leadership was measured using the Multifactor Leadership Questionnaire (MLQ-5X) developed by Bass and Avolio (1995). The MLQ assesses transformational, transactional, and laissez-faire leadership dimensions. Grit was measured using the Short Grit Scale (Grit–S) developed by Duckworth and Quinn (2009). Job Satisfaction by using the Job Satisfaction Survey (JSS) developed by Spector (1985). All questionnaires employed a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All instruments have been widely validated in educational research and have demonstrated reliability coefficients above 0.70 in prior studies (He 2023, Kaya et al. 2024). The questionnaire was adapted slightly to reflect the international school context.

After obtaining ethics clearance from the Tshwane University of Technology Faculty Research Ethics Committee, data were collected via an online survey distributed through Google Forms. Participants were informed about the purpose of the study, assured of anonymity and confidentiality, and informed that participation was voluntary. Consent was obtained electronically before completing the survey. The data collection period spanned six weeks, during which reminder emails were sent to enhance response rates.

Data Analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS version 29). Descriptive statistics (means, standard deviations, frequencies) were used to summarise demographic data. Pearson's correlation analysis was conducted to explore bivariate relationships among perceived leadership, grit, and job satisfaction. To test the proposed mediation model, Hayes' PROCESS macro (Model 4) was employed (Hayes 2022). Statistical significance was set at $p < .05$. Reliability of all measurement instruments was confirmed through Cronbach's alpha coefficients above the 0.70 threshold (Nunnally and Bernstein 1994).

The study adhered to established principles of ethical research. Informed consent was obtained from all participants, who were assured that their participation was voluntary and that they could withdraw at any time without penalty or consequence. Confidentiality and anonymity were guaranteed; no identifying information was collected or disclosed. Data were securely stored on a password-protected device accessible only to the researcher. Ethical approval was obtained from the Tshwane University of Technology (TUT) Faculty Committee for Research Ethics prior to data collection.

The purpose of this analysis was to examine the perceived influence of school leadership on grit and job satisfaction among international migrant teachers and to test whether grit mediates the relationship between leadership and job satisfaction. Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) and AMOS/SmartPLS. Descriptive statistics summarised demographic data and key study variables, while inferential statistics tested the proposed relationships. Mediation analysis was performed using Hayes' PROCESS macro (Model 4) with 5,000 bootstrap resamples (Hayes 2022).

Results

A homogeneous purposive sample of 103 respondents completed the online survey. Participants were professionals working in international schools following a globally recognised curriculum, such as the International Baccalaureate (IB) or Cambridge International Examinations, who were directly involved in teaching or classroom-related activities. The inclusion criteria reflected the study's focus on understanding how school leadership influences the grit and job satisfaction of teaching professionals. Therefore, the sample included teachers (≈ 73.8%), teacher assistants (≈ 3.9%), and management staff with teaching duties (≈ 11.7%), as these groups operate under similar leadership structures and experience comparable instructional demands. A smaller group of management staff without classroom duties (≈ 6.8%) was retained because their perceptions of leadership and job satisfaction remain integral to the organisational teaching environment and contribute to understanding leadership's wider influence within international schools.

Most respondents (44.7%) were between 18 and 35 years of age; 36.9% of the respondents were between 36 and 45 years old, while 18.4% were older than 48 years. The respondents' qualifications were as follows: 33.95% of respondents had a master's degree, while 24.25% had a bachelor's degree. A further 8.37% had a Bachelor of Education degree, 8.37% had a Postgraduate Certificate in Education (PGCE), and 7.76% had an honours qualification. The majority (36.89%) reported having taught between 11 and 20 years, while 27.18% had taught for 1 to 5 years and 17.48% for 6 to 10 years. Overall, the majority of the participants had between 1 and 20 years of service in education.

Respondents were employed in multiple countries—predominantly Sweden (45.63%), South Africa (12.62%), Italy (9.7%), the USA (4.85%), China (2.91%); other countries with less than 2.5% responses were Belgium, Egypt, France, Germany, Ghana, Hong Kong, India, Ireland, Italy, Kenya, Lithuania, Norway, Pakistan, Philippines, Tanzania, Thailand, Turkey, and Vietnam—ensuring that the

findings reflect diverse international school contexts while remaining focused on teaching-related experiences consistent with the study's aims.

Internal consistency was assessed using Cronbach's alpha. Following Barbera et al. (2020), alpha values ≥0.70 indicate acceptable internal reliability. As shown in Table 1, all scales exceeded this threshold, indicating strong internal consistency.

Table 1. *Reliability of Scales (Cronbach's Alpha)*

Variable	Cronbach's Alpha	Rounded Alpha	Interpretation
Leadership	0.8041	0.80	High reliability
Grit	0.6836	0.70	Acceptable reliability
Job Satisfaction	0.8681	0.87	High reliability

Source: Authors 2024

The mean and standard deviation for each continuous variable are reported in Table 2. Participants reported moderate grit levels (M = 25, SD = 3.70), moderate-to-high leadership perceptions (M = 51, SD = 6.30), and moderate job satisfaction (M = 42, SD = 5.90).

Table 2. *Means and Standard Deviations of Key Variables*

Variable	Mean	SD	Interpretation	Suggestion
Grit	25	3.70	Moderate	Perseverance and passion for a long-term goal
Leadership	51	6.30	Moderate–High	Leadership capability varies more widely across participants
Job Satisfaction	42	5.90	Moderate	Employees may be very satisfied, while others are less satisfied

Source: Authors 2024

Bivariate correlation analysis indicated significant positive associations among leadership, grit, and job satisfaction (r values between 0.45 and 0.75, $p < 0.01$). This suggests that stronger perceptions of supportive leadership are associated with higher levels of grit and satisfaction. This aligns with the Human Relations perspective (Mayo 1953), which posits that social support and recognition from leadership enhance motivation and well-being.

A multiple regression analysis (Table 3) was used to examine the influence of leadership and job satisfaction on grit. Results revealed that leadership significantly predicted grit ($\beta = 0.189$, $p = 0.034$), while job satisfaction did not have a statistically significant effect ($p = 0.266$).

Table 3. *Regression Analysis Predicting Grit*

PREDICTOR	COEFFICIENT	P-VALUE	INTERPRETATION
Leadership	0.189	0.034	Significant predictor of grit
Job Satisfaction	0.168	0.266	Not significant

Source: Authors 2024

This finding highlights the contextual nature of grit, as leadership appears to be a critical environmental factor that fosters perseverance and motivation among international educators (Caza and Posner 2019, Kaya et al. 2024).

The mediation model was tested using Hayes' PROCESS Macro (Model 4) to assess whether grit mediated the relationship between leadership and job satisfaction. The results indicate that grit significantly mediated the relationship between leadership and job satisfaction. A mediation effect occurs when the influence of one variable (leadership) on another (job satisfaction) operates through a third variable (grit). The reported p-value ($p = 0.002$) shows this indirect effect is statistically significant, meaning it is highly unlikely to have occurred by chance. The mediation pathway suggests that effective leadership enhances employees' grit—their perseverance and sustained effort toward long-term goals. Increased grit, in turn, leads to higher levels of job satisfaction. Therefore, leadership improves job satisfaction not only directly but also indirectly by strengthening employees' grit. Results are shown in Table 6.

Table 6. *Mediation Analysis using PROCESS Macro (Model 4)*

Path	Coefficient	Std. Error	t	p-value	95% CI	Interpretation
Leadership→ Grit (a)	0.189	0.088	2.15	0.034	[0.02, 0.34]	Leadership increases grit
Grit→ Job Satisfaction (b)	**0.037**	**0.012**	**3.08**	**0.002**	**[0.01, 0.06]**	**Grit predicts job satisfaction**
Leadership→Job Satisfaction (c')	0.385	0.067	5.75	0.000	[0.25, 0.51]	Direct effect significant
Indirect Effect (a × b)	0.022	—	—	—	[0.007, 0.042]	Mediation supported

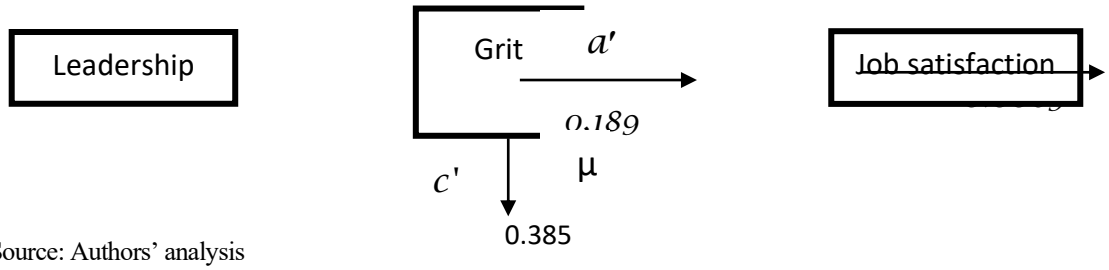
Source: Authors 2024

The results indicate that grit significantly mediated the relationship between leadership and job satisfaction. A mediation effect occurs when the influence of one variable (leadership) on another (job satisfaction) operates through a third variable (grit). The reported p-value ($p = 0.002$) shows that this indirect effect is statistically significant. The mediation pathway (Figure 1) suggests that effective leadership enhances employees' grit—their perseverance and sustained effort toward long-term goals. Increased grit, in turn, leads to higher levels of job satisfaction. Therefore, leadership improves job satisfaction not only directly but also indirectly by strengthening employees' grit.

This finding implies that organisations seeking to improve job satisfaction should focus not only on leadership development but also on cultivating grit among employees, as it is a key mechanism through which leadership exerts its positive influence.

Leadership has a substantial direct relationship with job satisfaction; a small but statistically significant portion of the leadership effect on job satisfaction appears to operate via grit. In practical terms, while leadership directly impacts job satisfaction (resources, conditions, support), some of that effect also flows through employees' perseverance and long-term commitment.

Figure 1. *Mediation Model of Leadership, Grit, and Job Satisfaction*



Source: Authors' analysis
Note: $p < 0.05$ for all significant paths

This finding reinforces Mayo's (1953) Human Relations theory, demonstrating that leadership behaviours—particularly those fostering trust, recognition, and support—can shape individual-level psychological resources such as grit, which subsequently enhance satisfaction and commitment (Rego et al. 2021, He 2023). It furthermore suggests that organisations seeking to improve job satisfaction should focus not only on leadership development but also on cultivating grit among employees, as it is a key mechanism through which leadership exerts its positive influence.

The results revealed that perceived school leadership had a significant positive influence on both grit and job satisfaction among international migrant teachers. Educators who viewed their leaders as supportive, communicative, and participative reported higher levels of perseverance and professional commitment, consistent with the Human Relations perspective (Mayo 1953), which holds that social and interpersonal conditions in the workplace directly shape motivation and satisfaction. Mediation analysis further indicated that grit partially mediated the relationship between leadership and job satisfaction, accounting for approximately 6% of the indirect effect. This suggests that effective leadership not only enhances job satisfaction directly but also indirectly strengthens it by cultivating perseverance and passion for long-term professional goals—psychological resources that promote engagement and resilience in demanding educational contexts (Duckworth et al. 2007, He 2023).

These findings underscore leadership as a critical contextual factor influencing both affective and motivational outcomes in international school environments. Leaders who demonstrate empathy, inclusivity, and participatory decision-making foster climates that support teachers' persistence through challenges such as cultural transition, curriculum adaptation, and professional identity negotiation (Derrah 2024, Ennerberg and Economou 2021). Aligning with the Human Relations model, the study highlights that teacher well-being and motivation stem not only from organisational structures but also from the social fabric of trust, recognition, and support that leadership cultivates. Cultivating such leadership practices may therefore be instrumental in enhancing teacher satisfaction, resilience, and retention across globally mobile educator populations.

Discussion

This study provides empirical evidence that perceived leadership behaviours in international school settings are positively associated with teachers' grit and job satisfaction. These findings are consistent with Human Relations theory (Mayo, 1953), which posits that leadership that fosters supportive relationships, recognition, and attention to employees' social and emotional needs creates conditions conducive to motivation and satisfaction. They also align with recent empirical research that links supportive leadership to resilience and satisfaction among educators (Kaya et al. 2024, He 2023).

The significant association between leadership and grit suggests that leaders' behaviours—such as providing support, clear communication, and professional development opportunities—enhance teachers' capacity to sustain effort and interest in long-term professional goals. These findings complement prior studies, which have shown that school climate and professional support influence teacher resilience and grit (Ismail 2023, Lee 2024).

The mediation analysis indicates that grit accounts for a modest but statistically significant portion of the relationship between leadership and job satisfaction. While leadership directly influences job satisfaction through working conditions, recognition, and policy support, it also indirectly shapes teachers' dispositions, reinforcing persistence and long-term engagement. This layered effect conceptually supports Mayo's emphasis on the interplay between social-psychological workplace processes and both affective (satisfaction) and motivational (grit) outcomes.

Limitations

Several limitations should be considered when interpreting the findings. First, the study employed a cross-sectional design, which limits the ability to infer causality between leadership, grit, and job satisfaction. While mediation analysis provides insight into potential mechanisms, longitudinal or experimental research would be required to confirm directional effects. Second, data were collected through self-report questionnaires, which may be influenced by social desirability bias or subjective interpretation of leadership and personal traits. Although validated instruments were employed, common method variance (CMV) cannot be fully excluded. Third, the sample size (n = 103) and its composition—predominantly teachers in international schools located in Europe, Africa, and Asia—may limit the generalisability of results to all international educators. Furthermore, the use of homogeneous purposive sampling means that participation was self-selected, which may have attracted individuals already engaged with leadership and professional development discourses. Finally, the study did not control for cultural, institutional, or organisational differences between international schools, which might influence perceptions of leadership and job satisfaction. Future research incorporating multi-site or cross-cultural comparative designs could address this limitation and strengthen external validity.

Contributions

Despite these limitations, the study makes significant contributions both theoretically and practically to the literature on international education and leadership.

From a theoretical standpoint, the findings extend the Human Relations model (Mayo 1953) by empirically demonstrating that grit functions as a psychological pathway linking supportive leadership to enhanced job satisfaction. This integration of classical motivational theory with contemporary non-cognitive constructs offers a more holistic understanding of teacher well-being and persistence in global educational contexts.

Practically, the results highlight the crucial role of school leadership in creating psychosocial climates that foster motivation and resilience among international educators.

Recommendations

The recommendations presented in Table 7 provide a comprehensive framework for enhancing teacher grit and job satisfaction in international school contexts. They integrate both conventional leadership development strategies and innovative approaches, such as digital mentoring, grit-enhancement programmes, and culturally tailored onboarding. The recommendations emphasise the dual role of leadership: directly shaping teachers' work environment through supportive and participative practices, and indirectly fostering individual psychological resources, such as grit, that sustain long-term motivation. Furthermore, they recognise the diversity of teacher roles and international contexts, encouraging interventions that are sensitive to professional responsibilities and cultural variations. Collectively, these strategies offer actionable guidance for school leaders and HR managers to improve professional fulfilment, retention, and resilience among migrant teachers, while also contributing to the broader evidence base on leadership, non-cognitive skills, and teacher outcomes.

Because this is an exploratory study, recommendations are tentative and framed as options for practice and future research rather than prescriptive mandates. Table 7 summarises practical and innovative strategies for fostering teacher grit and job satisfaction in international school contexts:

Table 7. *Recommendations for Enhancing Teacher Grit and Job Satisfaction*

No	Recommendations	Implementation example	Support Evidence
1	Leadership development	Provide training that emphasises supportive behaviours such as clear communication, psychological safety, and professional development.	He 2023 Kaya et al. 2024
2	Targeted support for non-classroom staff	Investigate working conditions and develop support structures for teacher assistants and other support staff to enhance job satisfaction and promote resilience.	Torres 2019 Chasani 2022
3	Selection and development	Include non-cognitive qualities (e.g., grit) as part of ethical recruitment and professional development processes.	Duckworth et al. 2007 Credé et al. 2024
4	Cautious evaluation	Assess interventions through longitudinal designs before scaling up.	Creswell and Creswell 2023
5	Grit enhancement programmes	Structured workshops, reflective journaling, goal setting, and peer coaching, delivered over multiple sessions.	Credé et al. 2024
6	Digital mentoring/peer networks	Implement digital mentoring platforms that link migrant teachers to experienced peers or leaders, including modules on cultural transition and accreditation.	Pesina 2025
7	Shared / distributive leadership	Establish teacher committees, peer-led professional learning communities, and participative decision-making forums.	Liu and Watson 2023
8	Instructional leadership + empowerment	Co-design culturally responsive pedagogy: assign meaningful, autonomous projects to strengthen professional purpose and grit.	Zahed-Babelan et al. 2024
9	Cultural and accreditation onboarding	Peer-buddy systems, accreditation guidance, and cultural adjustment workshops for migrant teachers, along with ongoing check-ins by leadership.	Chughtai 2018 Angwaomaodoko 2023
10	Longitudinal monitoring and mixed-method evaluation	Track teacher perceptions of leadership, grit, and satisfaction over time using surveys and interviews.	Credé et al. 2024
11	Contextualised interventions by role and country	Tailor leadership and support interventions to differences between teachers vs. assistants, and to local policy/cultural norms.	Liu and Watson 2023 Angwaomaodoko 2023

Source: Authors 2025

Conclusion

Perceived leadership behaviours in international school contexts are positively associated with teachers' grit and job satisfaction. Grit mediates a small but statistically significant portion of leadership's influence on job satisfaction, indicating that leadership fosters both direct and indirect pathways to professional fulfilment. Findings are exploratory, and caution is warranted in generalising results. Future research should employ larger, more representative samples and longitudinal designs to examine causality and explore how national context, accreditation processes, and school policies interact with leadership to shape the experiences of migrant teachers.

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The Nexus between Unemployment and Economic Growth: An Empirical Enquiry into Okun's Law on South Africa's Provinces (2008-2024)

By Ngonidzashe Chiranga[*]*, Samuel Chingoiro*[±] *& Stephen Zhanje*[○]

South Africa (SA)'s economic growth has largely been less than 1% which is relatively lower than the 3% average in the Sub-Saharan Africa region. On the other hand, unemployment has been over 28% over the 2013 to 2023 period. Questions emerge on the nexus between unemployment and economic growth, whether it still follows Okun's law at the SA provincial level. This study departs from the existing academic discourse by novelly contributing to academic scholarship through the following frontiers. Firstly, the study seeks to test using SA provincial data if a significant relationship exists in both the short-run and long-run, the unemployment - economic growth nexus still follows Okun's law and explore the underlying factors contributing to SA's unemployment crisis. The paper aims to achieve this through a panel of 9 SA provincial data empirically tested by employing three baseline models which include the Dynamic Fixed Effects (DFE) model, the Dynamic Fixed Effects with Mean Group (MG), and the Pooled Mean Group (PMG) mode utilising provincial quarterly data on unemployment rates and output in South Africa from 2008 to 2024. In the subsequent analysis, we refine the models by incorporating two additional techniques, the Panel-Corrected Standard Errors (PCSE) estimator, and the Fully Generalised Least Squares (FGLS) estimator. Overall, the results suggest that, while the short-run impact of unemployment on GDP is less clear, the long-run effects indicate a positive and significant relationship, debunking the relevance of Okun's Law in understanding the dynamics between unemployment and economic output. This study aims to contribute to policymaking and broaden the understanding from an emerging country perspective.

Keywords: *Economic growth, Okun's law, South Africa, Unemployment, Panel Autoregressive Distributed Lag method.*

Introduction and Background

South Africa's (SA) economic growth from 2015 has been largely lower than 1% compared to the 3% average in the Sub-Saharan region. On the other hand, unemployment has averaged over 28% since 2015. Slow economic growth has been singled out by different scholars as one of the chief causes of unemployment.

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Following Okun's law[1], is there a scientific basis to question the efficacy of this law using SA provincial data? Single-country studies by Priambodo (2021), Tabash, Farooq, Safi, Shafiq, and Drachal (2022) and Gonese, Sibanda, and Ngonisa (2023), contributed to the debate on Okun's law for single countries. Yet, when considering panel cross-country studies, mixed results on the nexus occur. Much of the scholarship debates emanate from the non-agreement of results in the short and long run.

However, there have been few country-specific studies conducted on Okun's law that considered sub-regions within the country. For instance, Christopoulos (2004), did a study in Greece using unit roots in which 6 of the 13 regions found consistent results with Okun's specification. Also, Villaverde and Maza (2009), did a study in Spanish provinces using data from 1980 to 2004, in which the majority of areas found an inverse relationship between unemployment and economic growth. In this respect, the novelty of this study stems from a scholarship contribution in addressing the following research question:

What is the short and long-run impact of Unemployment (U) on economic growth (EG) in South Africa at the provincial levels? The study aims to solve the these research questions using three baseline equations namely, the DFE, MG and PMG. Additionally, two techniques are applied namely PCSE and the FGLS to improve the robustness of the results. The rest of the paper is as follows: Section 2 is a presentation of the stylised SA unemployment and GDP data. Afterwards, section 3 is a Review of related literature, which is followed by Research methods and a discussion of results. Finally, the paper presents a conclusion and policy implications.

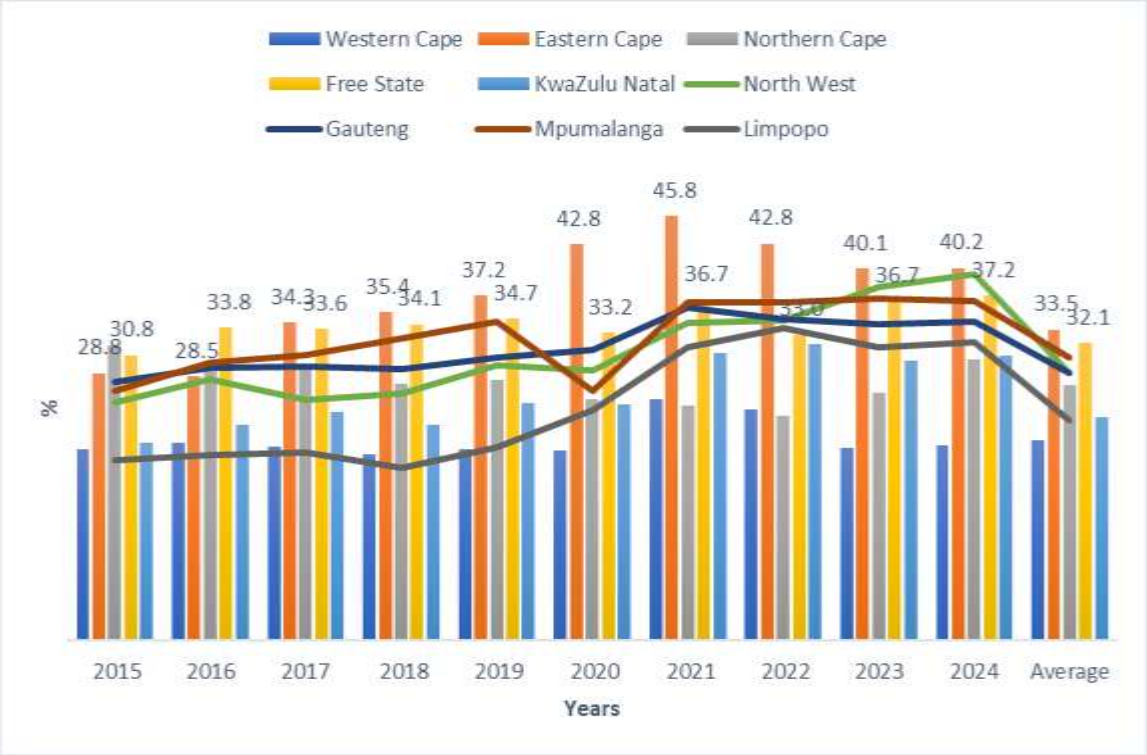
Unemployment and Economic Growth Trends in SA Provinces (2013-2023).

Figure 1 presents the average unemployment statistics for SA's 9 provinces, of which Eastern Cape, KwaZulu Natal and Limpopo Provinces are considered rural. On the other hand, the Northern Cape, Western Cape, Eastern Cape, and KwaZulu-Natal have a coastline. Does it imply this has any added benefits to lowering average provincial unemployment rates? What is striking is that the Eastern Cape registered the highest unemployment of 45.8% in 2021; this may be attributed to the fact that it is a rural-based province. This is followed by the Free State Province, with farms also surround. Does it follow then that most people working on farms are not recorded, or do they consider themselves unemployed? Those discussions make the official unemployment rate from STATS SA the subject of scrutiny. However, for purposes of this study, the strict definition[2] of unemployment is followed. On the other hand, the Western Cape, Gauteng, and KwaZulu Natal have repeatedly registered lower unemployment rates.

[1]When the economy is growing strongly it follows that unemployment will decrease but a non-growing economy has an increase in unemployment (Hjazeen, Seraj, & Ozdeser, 2021)

[2]Following international standards, a person should meet three criteria to be considered unemployed. First, they (a) did not work in the reference period; (b) were available to take up a job had one been offered in the week before the reference period and (c) actively sought work within the past month

Figure 1. *Average Provincial Unemployment in SA (2008-2024)*

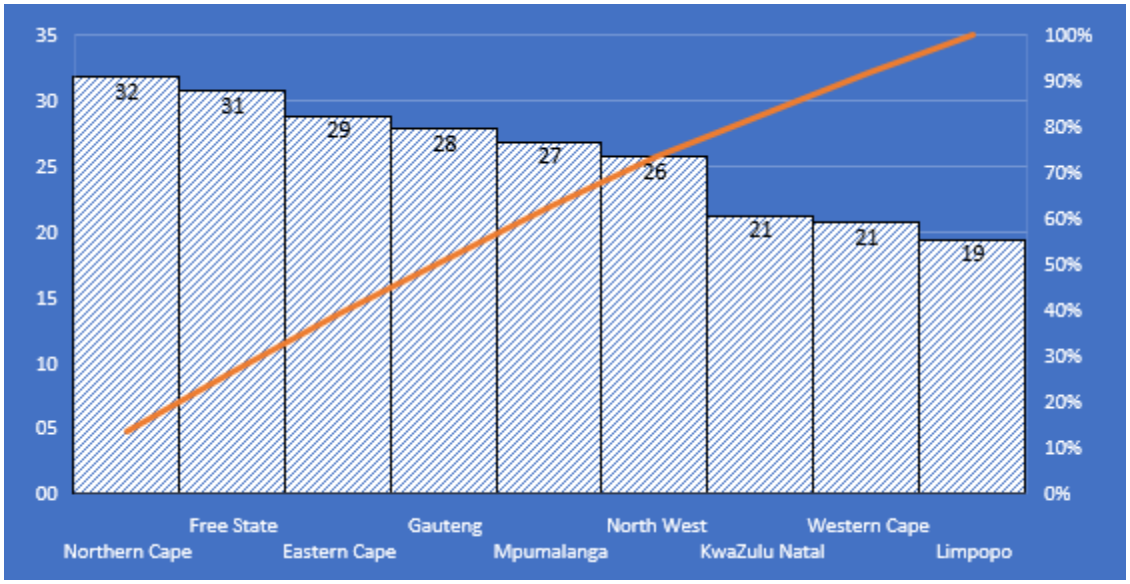


Source: STATS SA (2008-2024)

Is there enough scientific evidence to justify the claim that unemployment is related to being in a rural or urban province? The stylised facts, on the contrary, show that the Northern Cape, which cannot be classified as not rural, had the highest average unemployment rate of 31.9% followed by the Free State, also another not-so-rural province. However, the Eastern Cape (a rural province) is one of the top 3 highest provinces with unemployment. In a way, Limpopo is a rural province but has the lowest average unemployment of 19.4% just below the Western Cape at 20.7%. Does this imply that in a rural province, people are employed in subsistence farming, yet they don't derive any form of compensation? What is striking are the many cars that trek back via N1 North[3] to Limpopo province from Gauteng province every month, indicative that most Limpopo economically active population do not reside in the province but rather remit back to the province. Hence, there is little evidence to justify that unemployment can be traced to a province being either rural-based or urban-based or based on having a coastline or being landlocked unless this is subjected to econometric estimation to measure impact elasticities.

[3]The N1 National Route emanates from Cape Town (Western Cape) and goes through Bloemfontein (Free State), Johannesburg, Pretoria (Gauteng), and Polokwane (Limpopo) to Beit Bridge on the border with Zimbabwe.

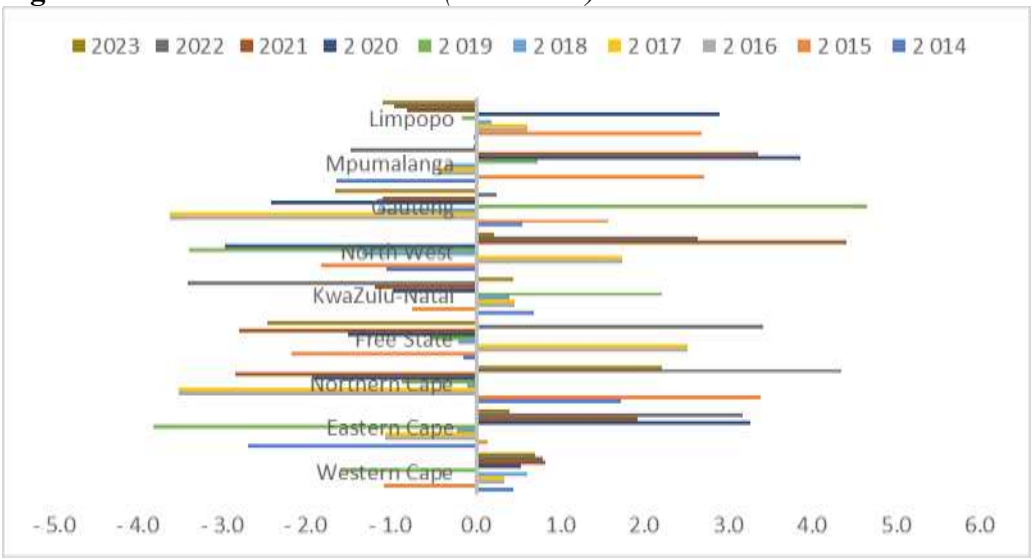
Figure 2. *Average Unemployment grouped from Highest to Lowest (2013-2023)*



Source: STATS SA (2024)

Furthermore, from Figure 3, the Northern Cape province registered the highest GDP growth rate of 2.2%. That is rather surprising given there are not many companies situated in the province or perhaps a bigger company relocated there and hence the multiplier effect caused a lot of economic activity resulting in GDP growth. The irony is it is the province registering the highest unemployment. Could it be a capital-intensive company relocated to the Northern Cape that does not translate to employment growth?

Figure 3. *Provincial Growth Rates (2014-2024)*



Source: STATS SA (2014-2024)

However, from Table 1, the contributions from the different economic provincial sectors in the Northern Cape province are provided. Community services have dominated the contributions at the provincial level, from 28.4% in 2021 to

27.5% in 2022. Still, it does not justify why unemployment is still high in this province. Furthermore, the mining sector follows, which is a capital-intensive industry. Is there scope to speculate that mines are adopting Artificial Intelligence (AI) as a factor of production in replacing workers? This may require further scrutiny, but at face value, South African mines are deep and are increasingly becoming dangerous for humans to go underground. So, from a profit motive and safety motive, mining has drifted towards robotic mining as it saves costs and reduces the headache of mining fatalities. All in all, unemployment will increase despite an economic growth increase, a possible explanation of this puzzle.

Table 1. *Economic Contributions in the Northern Cape Province (2021-2022)*

Sector	**Contributions from different industries in the Northern Cape Province (%)**	
	2021	**2022**
Primary Sector	**30.6**	**30.8**
Agriculture	7.5	8.4
Mining	23.1	22.4
Secondary Sector	**8.5**	**8.6**
Manufacturing	3.8	3.7
Electricity	3.1	3.2
Construction	1.7	1.7
Tertiary Sector	**60.9**	**60.5**
Trade	10.8	10.9
Transport	7.5	8.1
Finance	14.1	14.0
Community Services	28.4	27.5
Total	**100.0**	**100.0**

Source: Northern Cape Socio-economic Review (2024)

In a way, the stylized facts from Northern Cape province are at variance with Okun's law postulations. Does it imply Okun's validity only applies when there is GDP growth associated with expanding a labour-intensive industry, which is not the case with the advent of artificial intelligence (AI)? GDP can indeed increase, yet people are unemployed. This is the quagmire most developing countries find themselves in when they overly and excitedly adopt AI into their production systems in environments with vast available economically active populations, resulting in agitations from the voting youths and protestant voting patterns that usually take ruling parties by surprise.

From Table 2, the Eastern Cape registered the lowest GDP growth rate in 2014 at 2.7% followed by Mpumalanga province at -1.7%. On the other hand, Gauteng province has, over the years positive GDP growth rates, but somehow in 2023, there was a lower negative growth of -1.7%. Could the province be in a technical recession? That remains unclear.

Table 2. *SA Provincial GDP Growth Rates (2014-2023)*

Province	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Western Cape	0,4	-1,1	0,3	0,3	0,6	-1,6	0,5	0,8	0,8	0,7
Eastern Cape	-2,7	0,1	-1,1	-1,1	-0,2	-3,9	3,3	1,9	3,2	0,4
Northern Cape	1,7	3,4	-3,6	-3,6	-0,1	-0,9	-1,9	-2,9	4,3	2,2
Free State	-0,2	-2,2	2,5	2,5	-0,2	-0,5	-1,5	-2,8	3,4	-2,5
KwaZulu-Natal	0,7	-0,8	0,5	0,5	0,4	2,2	-1,0	-1,2	-3,4	0,4
North West	-1,1	-1,8	1,7	1,7	-1,4	-3,4	-3,0	4,4	2,6	0,2
Gauteng	0,5	1,6	-3,7	-3,7	-1,2	4,7	-2,4	-1,1	0,2	-1,7
Mpumalanga	-1,7	2,7	-0,5	-0,5	-0,4	0,7	3,9	3,3	-1,5	0,0
Limpopo	0,0	2,7	0,6	0,6	0,2	-0,2	2,9	-0,8	-1,0	-1,1

Source: STATS SA (2014-2023)

Review of Literature

The literature on Okun's law can be traced to the scholarship by Priambodo (2021), Aaronson, Daly, Wascher, and Wilcox (2019), Banda, Ngirande, and Hogwe (2016) and Ali, Osman, Hassan, and Osman (2022) where they consider the Keynesian economic view on the macroeconomy. More specifically, the economy is made up of consumers (C), investors (I), government (G), and net exports(X-M). Put simply, aggregate demand, Y=C+I+G+X-M. On the other hand, a low-investment climate has been prevalent in SA, and why this is so may be due to several factors. This follows that investment by nature depends on expectations, which depend on a quantum of factors, some of which include respect for property rights, favourable investment government policies, the tax regime in the country, and inflation and interest rate expectations, to mention just a few. Investors follow the country trends and are guided, unfortunately, by recommendations from rating agencies like Moody's, which, with their grading, can magnify the unemployment crisis even further, as investors hold back on long-term investments in line with rating agencies' recommendations.

On the other hand, SA's export basket is largely dominated by base metals that suffer volatility from world prices, coupled with high labour costs, which makes SA goods on the world market price uncompetitive. Further, import demand for non-essentials has largely been driven by external aggressive persuasive advertisements on social media platforms from foreign companies, and with a high internet penetration ratio, the unsuspecting consumer imports goods that otherwise could have been bought in a store next door. It is equally worth noting that the world has become one big global village that somehow seems to punish losers and reward winners. Is SA losing in this game of trade where they are exporting what the world essentially has more substitutes for but importing essential goods that are relatively price inelastic like crude oil? Equally, SA is importing non-essentials that are also available locally, which results in the perennial unemployment problem. But in a free world, can you control what people do with their money, or can you only put a cap on how much they can spend outside? The question that remains unclear is, this is working for or against SA's fight against

youth unemployment. Interestingly, Oner (2020) maintains that unemployment of skilled workers is pricing them out of the labour market by demanding higher reservation wages than what the employers can pay. Another possibility is that workers earn below minimum wage salaries than the gazetted minimum wage, a phenomenon prevalent in the farming industry. In this respect, does it follow thereafter that unemployment registered in the Free State Province, a predominantly commercial farming area, is underreported, as those employed are not registered, as employers fear being caught paying below minimum wage? Similarly, Suma (2017) saw that unemployment may increase the moment wages rise above realistic break-even levels that trigger the attractiveness of AI as an alternative to labour.

Theoretical Framework on Okun's Law

This paper is based on Okun's foundational work (1962), which predicts an inverse relationship between output and unemployment. A substantial body of literature has shown that there are two versions of models that can be used to project this relationship (Christopoulos, 2004; Dajcman, 2018; Gonese, Sibanda and Ngomisa, 2023; Ibourk and Elaynaoui, 2024). In the gap model version, the relationship is expressed as follows:

$$U_t - U^* = \varphi(Y_t - Y^*) + \varepsilon_{it} \quad (1)$$

where; U_t is the unemployment rate in period t and U^* is the natural unemployment rate. The right-hand side depicts the output gap, where Y_t is the real output in period t and Y^* is the potential output of the country. Researchers who estimated the relationships of this version are all premised on the principle that when an economy produces output above its potential, the unemployment rate must generally fall (Ibourk and Elaynaoui, 2024). Thus, increases in real output improve the prospects of reducing unemployment rates. However, the downside of estimating U^* and Y^* is that they are unobservable variables and hence, may lack predictive power (Lancaster and Tulip, 2015). Advanced approaches to estimating the unobservable variables still have limitations for oversimplification and cannot fully address institutional factors such as unionism and minimum wages (Jacob and Wong, 2018). Okun's law can also be expressed using the differences version.

$$U_t - U_{t-1} = \beta(Y_t - Y_{t-1}) + \varepsilon_{it} \quad (2)$$

where the left-hand side represents the change in unemployment rate between two periods, and the right-hand side represents the change in GDP expressed in logs. The difference in (2) can be derived from the gap version in (1). However, researchers usually use the differences version as a simpler and separate version of modelling Okun's law (Jacob and Wong, 2018). The current study adopts the differences version of the conceptual approach for Okun's law to circumvent the limitations associated with estimating the unobservable variables in (1).

Empirical Review

The nexus between unemployment and economic growth has attracted many outcomes. There is generally a lack of consensus, which has attracted a variety of outcomes even currently. For instance, a country-specific study was done in Jordan using panel data from 1991 to 2019 using ARDL by Hjazeen et al. (2021) and found a negative relationship between economic growth and unemployment. In agreement, Khan, Xue, Zaman, and Mehmood (2023), did a study in Pakistan using the ARDL bounds test with data from 1990 to 2019 also confirmed a significant negative relationship between unemployment and economic growth, in agreement with Okun's law findings. Furthermore, Conteh (2021), did a panel study applying an ARDL bounds test on Liberia from 2001 to 2019, but found no long-run relationship between unemployment and economic growth.

However, Ibourk and Elaynaoui (2024)'s study from 39 African countries applied a first differences Hodrick-Prescott (HP) filter. The findings suggest that most African countries have a weak and non-existent relationship between unemployment and economic growth. Furthermore, when you consider the Southern African Development Community (SADC) region, Gonese et al. (2023), used ARDL and the Pooled Mean Group (PMG) estimation technique on a sample from 1980 to 2019 and found that there was a long-run positive relationship between unemployment and economic growth.

On the other hand, for country-specific studies from South Africa, a study by Marinkov and Geldenhuys (2007), found Okun's law to be valid. However, a study by Banda et al. (2016), also from South Africa, found a positive relationship between economic growth and unemployment in direct contrast with other empirical findings by other authors. Could it be because Banda did not apply ARDL like most authors, but instead used Johansen's cointegration from SA's time series data from 1994 to 2013?

In another study, Christopoulos (2004), did a study in Greece and considered Spanish provinces using data from 1980 to 2004 and found similar results, which indicated that most regions follow Okun's law. The panel set up for a country-specific study used in this study shall be adopted in this study by considering SA's 9 provinces as a micro panel from 2015 to 2023, a clear departure from most studies that usually applied ARDL over long periods. The absence of a panel study using a country's provinces from a developing and emerging country perspective makes this study unique, and the novelty contributes to the academic scholarship.

Evans (1989), panel data from single-country studies found an inverse relationship between economic growth and unemployment. However, Al-Habees and Rumman (2012) used VECM, and the findings suggested a negative and significant relationship between economic growth and unemployment in the long run. But in the short term, the economic growth and unemployment nexus had an insignificant positive effect, even though the population growth variable had a contrasting effect on economic growth.

Materials and Methods

This paper utilises provincial quarterly data on unemployment rates and output in South Africa from 2008 to 2024 to estimate Okun's coefficients for each of its nine regions. Both versions of Okun's models in (1) and (2) can be nested into several econometric models. Therefore, to provide a more comprehensive understanding of the underlying relationship between the unemployment rate and GDP growth, and ensure the robustness of the findings, this study embraced several panel models of the differences-version in (2). Since each model is shaped by different assumptions, reporting results across the models helps to evaluate the robustness of the findings and to verify whether the Okun's law holds under the different assumptions.

We employ three baseline models, which include the Dynamic Fixed Effects (DFE) model, the Dynamic Fixed Effects with Mean Group (MG), and the Pooled Mean Group (PMG) model. These models provide a solid foundation for capturing both cross-sectional and time-series variations within the data. In the subsequent analysis, we refine the models by incorporating two additional techniques, the Panel-Corrected Standard Errors (PCSE) estimator, which adjusts for potential heteroscedasticity and contemporaneous correlation, and the Fully Generalised Least Squares (FGLS) estimator, which is designed to address issues of endogeneity and serial correlation in the panel data.

Dynamic Fixed Effects (DFE) Model

The DFE model is useful for controlling for unobserved, time-invariant heterogeneity across the nine regions of South Africa. A Hausman test was first applied to choose between the Random Effects (RE) model and the FE model. It is employed in the analysis for capturing time-dependent effects of the unemployment rate and GDP output, where the past behaviour of the dependent variable influences the current value (Baltagi, 2008). The estimated DFE model for this study is specified in (3):

$$Ln(\Delta GDP_{it}) = \alpha_i + \beta \Delta U_{it} + \gamma Ln\left(\Delta GDP_{i,t-1}\right) + \varepsilon_{it} \quad (3)$$

where $Ln(\Delta GDP_{it})$ is the natural logarithm of the change in GDP for the province i in period t, and ΔU_{it} is the change in the unemployment rate for the province i and time t. The fixed effects intercept α_i represent province-specific, time-invariant factors that could influence GDP growth but are not included in the model, such as geographic factors (i.e coastal or non-coastal, and urban or rural province), and economic structure (for example, agrarian-based or industry-based province). $Ln\left(\Delta GDP_{i,t-1}\right)$ is the lagged change in GDP, i.e., the growth rate of GDP in the previous period (t-1). The coefficient for the lagged change in GDP (γ) captures the persistence or momentum in GDP growth from the previous period (t-1).

The key goal of this model is to investigate the relationship between changes in the unemployment rate and the rate of growth in GDP in the nine provinces of South Africa. A negative in the Okun's coefficient (β) would suggest that an increase in the unemployment rate is associated with slower GDP growth or potentially negative GDP growth, which aligns with the idea behind Okun's Law.

Dynamic Fixed Effects with Mean Group (MG) Model

We introduce the MG model in the analysis to account for heterogeneous coefficients across the nine regions (Wooldridge, 2009). The estimated MG model for this study is specified in (4) below:

$$Ln(\Delta GDP_{it}) = \alpha_i + \beta_i \Delta U_{it} + \gamma Ln\left(\Delta GDP_{i,t-1}\right) + \varepsilon_{it} \quad (4)$$

where β_i is the province-specific coefficient for the change unemployment rate in period t. After estimating β_i for each province, the Mean Group (MG) estimator computes the average of the $\beta_i's$ to get a single estimate for the effect of change in the unemployment rate on change in GDP across all provinces.

Pooled Mean Group (PMG) MODEL

We used the PMG to allow for the estimation of both long-term and short-term relationships in panel data while accommodating potential heterogeneity across individual cross-sections. The PMG estimator assumes that the long-run coefficients are the same across cross-sectional units, while the short-run dynamics may differ (Pesaran, Shin, and Smith, 1999; Pesaran and Smith, 1995). The estimated model is specified in (5) as follows:

$$Ln(\Delta GDP_{it}) = \alpha_i + \lambda_t + \varphi \Delta U_{it} + \gamma Ln\left(\Delta GDP_{i,t-1}\right) + \varepsilon_{it} \quad (5)$$

where λ_t represents time-specific effects, and φ is the vector of long-run coefficients (assumed to be common across cross-sections).

Panel Corrected Standard Errors (PCSE)

We introduced the PCSE model to ameliorate the risks associated with heteroscedasticity and autocorrelation within the panel data (Baltagi, 2008). The model adjusts the standard errors of the coefficient estimates to account for the potential correlation between cross-sectional units and heteroscedasticity. The estimated static FE model for this study is as already specified in 2(a). However, the static fixed effects model with PCSE adjusts for unobserved heterogeneity (captured by α_i) and corrects for heteroscedasticity and serial correlation in the panel data, ensuring robust standard errors.

Feasible Generalised Least Squares (FGLS) Model

The FGLS arguably has a more efficient estimator in the presence of heteroscedasticity and autocorrelation, and helps to determine if the results are sensitive to the assumptions of error structures (Miller and Startz, 2018). The first step in the procedure to estimate the FGLS began by estimating the baseline model in (2a) to obtain the residuals. These were used to capture the error structure that is not explained by the DFE model (2a). The errors are modelled in (6) below:

$$\varepsilon_{it} = \rho\varepsilon_{i,t-1} + \mu_{it} \quad (6)$$

where ρ is the coefficient capturing the serial correlation and μ_{it} is the idiosyncratic error.

Variables of Interest and Proxies

The variables of interest in this study and their proxies are as follows:

(i) *Unemployment rate (Unemprt):* The provincial quarterly data for unemployment rate was obtained from STATS SA
(ii) *Natural log of the change in real GDP* $Ln(\Delta GDP_{it})$: Real GDP for each quarter in each year sourced from STATS SA… It is computed by applying the Harmonised Index of Consumer Prices (HICP) on nominal GDP, with 2015 used as the base year.

Discussion of Results

Correlation Analysis Results

Table 3 shows the correlation analysis results of the model variables, and the correlation coefficients range from 0.0328 to 0.2263. Such values depicted in Table 3 show that there is a low correlation between the variables which indicates that the model under consideration is bereft of the problem of multicollinearity.

Table 3. *Correlation Matrix*

Variable	lnΔGDP	lnGDP	Diffunemprt	Unemprt
lnΔGDP	1.0000			
LnGDP	0.0494 (0.2264)	1.0000		
Diffunemprt	0.1660*** (0.0000)	0.0389 (0.3408)	1.0000	
Unemprt	0.0328 (0.4224)	0.0383 (0.3481)	0.2263*** (0.0000)	1.0000

Authors' computations

Cross-sectional Dependence and Homogeneity Tests

The utilisation of provinces in this panel study evokes the need to determine whether cross-sectional dependence or independence exists across cross-sections. The results in Table 4 show that the null hypothesis of cross-sectional independence is rejected at a 5% level of significance and even at a 1% level. Such an outcome signifies that there is cross-sectional dependence among cross sections, which calls for the utilisation of models that accommodate such a violation.

Table 4. *Cross-sectional Dependence Test Results*

Variable	CD-test	P-value	Average joint T	Mean ρ	Mean abs(ρ)
ln∆GDP	24.988	0.000	66.78	0.51	0.70
LnGDP	48.904	0.000	67.00	1.00	1.00
Diffunemprt	19.008	0.000	66.78	0.39	0.39
Unemprt	22.701	0.000	67.00	0.46	0.51

Authors' computations

The null hypothesis, indicating the existence of homogeneity in the model, was tested in this study. Table 5 shows the homogeneity/heterogeneity results, which indicate that the null hypothesis of homogeneity among cross-sections is not rejected at 5% level. This result justifies the existence of homogeneity among South African provinces, which is a surprising result.

Table 5. *Homogeneity/Heterogeneity Test*

$ln\_diffgdpr_{it} = \beta_0 + \beta_1 diffunemprt_{it} + \varepsilon_{it}$	Statistic	P-Value
Delta_tilde	1.896	0.058
Delta_tilde_adj	1.940	0.052

Source: Authors' estimations

Stationarity Testing of the Variables

Given that the null hypothesis of cross-sectional independence was rejected at a 5% level of significance justified the use of the second-generation panel unit root test (CIPS) to augment the first-generation panel unit root (IPS) to enhance the robustness of regression results. To ensure that the above panel models produce valid, reliable, and interpretable results, the econometric procedures followed in this study began by testing for and addressing the panel unit root issues. The results summarised in Table 6 indicate that the null hypothesis of the existence of a unit root for the LNGDP variable is not rejected at 5% in level but at 1st difference when IPS without trend is employed. However, with IPS with the trend, the null hypothesis of the existence is rejected at the level on the onset. Thus, stationarity is realised at first difference and at level concerning the LNGDP variable when the IPS panel unit root technique without or with trend is applied, respectively. On the other hand, the second-generation panel unit root (CIPS) without or with trend rejects the null hypothesis of the existence of a unit root at the first difference at the 5% level, which justifies stationarity at the first difference for the LNGDP variable.

The panel unit root results when IPS with trend, CIPS without trend and CIPS with trend panels are considered, the null hypothesis of the existence of a unit root is rejected at the level for the Unemprt variable. Whereas the panel unit root results of IPS without trend results for the Unemprt variable show that the null hypothesis of the existence of a unit root is rejected at the first difference at a 5% level of significance. Overwhelmingly, stationarity is realised at a level concerning the Unemprt variable. The realisation of stationarity not beyond 1st difference justifies the determination of cointegration among model variables.

Table 6. *First- and Second-generation Panel Unit Root Test Results*

	1st Generation		2nd Generation	
Variables/Unit root tests	**IPS w/o trend**	**IPS w trend**	**CIPS w/o trend**	**CIPS w trend**
GDP	1.3249 $I(0)$ -22.0535*** $I(1)$	-3.1701*** $I(0)$ -21.9606*** $I(1)$	-2.236* $I(0)$ -6.080*** $I(1)$	-2.656 $I(0)$ -6.285*** $I(1)$
LNGDP	-1.2718 $I(0)$ -20.3018*** $I(1)$	-3.1313*** $I(0)$ -19.9323*** $I(1)$	-2.901*** $I(0)$ -6.190*** $I(1)$	-3.299*** $I(0)$ -6.420*** $I(1)$

Authors' computations ***p<0.01, **p<0.05, *p<0.1

Cointegration Test Results

Pedroni's cointegration tests and the Westerlund (2007) ECM panel cointegration test results are depicted in Tables 7 and 8, respectively. Both panel unit root methodologies tested the null hypothesis of the existence of a long-run relationship among model variables. The results in Tables 7 and 8 show that the null hypothesis of no cointegration is rejected at a 5% level of significance, indicating that model variables are cointegrated in the long run, and this calls for the estimation of the regression model in the study.

Table 7. *Pedroni's Cointegration Tests*

Test Statistics	Panel	Group
V	18.57	
Rho	-36.33	-30.62
T	-43.96	-76.97
Adf	-36.66	-61.09

Authors' computations

Table 8. *Westerlund (2007) ECM Panel Cointegration Test Results*

Statistic	Value	Z-value	P-value	Robust P-value
Gt	-8.762	-23.613	0.000	0.000
Ga	-2600	-1100	0.000	0.000
Pt	-6.471	-0.153	0.439	0.900
Pa	-915.798	-443.711	0.000	0.000

Authors' computations

Discussion of Empirical Results

In this section, we present the empirical results derived from the econometric modelling of Okun's Law, specifically focusing on the relationship between the change in GDP and the change in the unemployment rate. The natural logarithm of the change in GDP is modelled as a function of the change in the unemployment rate, using panel data across multiple quarterly periods for nine South African provinces.

This section aims to provide a comprehensive understanding of how these models contribute to estimating the dynamic relationship between unemployment and GDP growth changes, ultimately testing the validity of Okun's Law across different specifications and accounting for various econometric challenges. Table 9 presents the results for the three baseline models, highlighting the estimated coefficients and statistical significance for the relationship between the change in unemployment rate and the change in GDP. Table 4 also shows the results of the Mean Group (MG), Differenced Fixed Effects (DFE) and the Pooled Mean Group (PMG) models. Also, the results in Table 9 show that in the long run (LR), the three models oppose Okun's law. The coefficient of 0.00243 represents a change in GDP as influenced by the change in the unemployment rate in the MG long-run model. That is, on average, a one per cent increase in the unemployment rate is associated with a 0.00243 per cent increase in GDP over the long run. Similarly, the coefficients of the change in the unemployment rate in the DFE and PMG bring about a 0.00173 and 0.000636 per cent increase in GDP over the long run, respectively. Such an outcome is in line with findings by other scholars that contradict Okun's law (Banda et al., 2016; Gonese et al., 2023)

Table 9. *Empirical Results of the Baseline Models*

	MG **Model (1)**		**DFE** **Model (2)**		**PMG** **Model (3)**	
VARIABLES	**LR**	**SR**	**LR**	**SR**	**LR**	**SR**
Short-Run (SR)						
$Ln(\Delta GDP_{i,t-1})$		-1.049***		-1.000***		-1.071***
		(-38.17)		(-1,330)		(-38.76)
D.diffunemprt		-0.0001		-0.00004		0.000586**
		(-0.823)		(-0.227)		(2.040)
Long-Run (LR)						
diffunemprt	0.00243**		0.00173***		0.000636***	
	(2.326)		(6.470)		(6.426)	
Constant		15.35***		14.64***		15.68***
		(38.16)		(1,332)		(38.70)
Observations		593		593		593
Hausman Test	MG vs PMG		MG vs DFE		DFE vs PMG	
	Chi2(2) =2		Chi2(1) =0.00		Chi2(2) =-122.92	
	Prob>chi2=0.1570		Prob>chi2=0.9964		Prob>chi2=0.0000	

Furthermore, the MG, DFE and the PMG appear to converge in the long run as the speed of adjustments of -1.049, -1 and -1.071, respectively, are within acceptable limits. Although statistically insignificant, the MG and DFE short-run models seem to sympathetically move in the direction of Okun's unemployment coefficient. A coefficient of -0.0001 for the change in the unemployment rate in the MG short-run model suggests that a one percent increase in the unemployment rate is associated with a very small decrease in GDP (by 0.0001 per cent) in the short-run. However, since this coefficient is statistically insignificant at the 5 per cent level, we cannot confidently infer that this relationship holds in the short run. The lack of statistical significance implies that, based on the current data, the short-

run effect of changes in the unemployment rate on GDP growth is not robust enough to make a definitive conclusion. The same conclusion is inferred from the DFE coefficient of 0.00004. In contrast, the PMG short-run coefficient of 0.000586 for the change in the unemployment rate indicates that a one percent increase in the unemployment rate is associated with a 0.000586 per cent increase in GDP in the short-run, which opposes Okun's directional effect. Since this coefficient is statistically significant at the 1 per cent level, we can conclude that there is a meaningful relationship between the change in unemployment and GDP growth in the short run. This suggests that, in the short term, an increase in unemployment is positively related to economic output, although the magnitude of the effect is extremely small.

To ensure the robustness and reliability of the model estimates in Tables 10 and 11, we employ the PCSE and the FGLS models, which cater to cross-sectional dependence among the cross sections. Such models also control for potential issues such as heteroscedasticity, serial correlation, and endogeneity, which could undermine the validity of the model results. That is, the PCSE adjusts for heteroscedasticity and contemporaneous correlation, while the FGLS accounts for endogeneity and serial correlation, ensuring more reliable and consistent parameter estimates. Tables 10 and 11 show the results of the PCSE and the FGLS, respectively, along with their diagnostic test results.

Table 10 shows the results of the PCSE Model under three error structures across the panels by assuming the existence of panel-level heteroscedasticity and correlated panels, panel-level heteroscedasticity only and independence across panels. The Okun's coefficient under all the error structures is tightly closed and only ranges from 0.0333 and 0.0358 and is all significant at a 5% level. In all conditions, the data does not support Okun's prediction, which synchronises with the findings of other scholars like Priambodo (2021) and Ali, Osman, Hassan, and Osman (2022). For instance, a coefficient of 0.0358 for the change in the unemployment rate in the PCSE model indicates that, after accounting for heteroscedasticity and contemporaneous correlation, a one per cent increase in the unemployment rate is associated with a 0.0358 per cent increase in GDP. The findings are consistent with the results under the FGLS in Table 11, with Okun's coefficient ranging from 0.00278 to 0.0358.

Table 10. *Empirical Results for the PCSE Model*

Error structure across the panels	Panel level heteroscedastic and correlated across panels			Panel level heteroscedastic			Independent across panels		
Form of Autocorrelation	No Auto	AR (1)	Panel specific AR (1)	No Auto	AR (1)	Panel specific AR (1)	No Auto	AR (1)	Panel specific AR (1)
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr
diffunempr	0.0333***	0.0349***	0.0358***	0.0333***	0.0349***	0.0358***	0.0333***	0.0349***	0.0358***
	(17.12)	(14.60)	(17.94)	(3.085)	(3.132)	(3.100)	(4.130)	(4.205)	(4.289)
Constant	14.62***	14.62***	14.62***	14.62***	14.62***	14.62***	14.62***	14.62***	14.62***
	(2,287)	(2,438)	(2,616)	(662.0)	(746.4)	(855.4)	(662.0)	(746.4)	(755.2)
Observations	602	602	602	602	602	602	602	602	602
R-squared	0.028	0.359	0.956	0.028	0.359	0.956	0.028	0.359	0.956
Number of provinces	9	9	9	9	9	9	9	9	9
chi2 (Wald test)	293.1***	213.2***	321.9***	9.520***	9.810***	9.612***	17.05***	17.69***	18.40***
z-stats in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

From Table 11, a coefficient of 0.0333, which shows the change in the unemployment rate in the FLGS model, suggests that, after accounting for endogeneity and serial correlation, a one per cent increase in the unemployment rate is associated with a 0.0333 per cent increase in GDP. This result is statistically significant at the 1 per cent level, indicating that the relationship between the change in unemployment and GDP growth is both strong and reliable, even after addressing potential econometric issues such as endogeneity and serial correlation. The consistency of the positive effect in Okun's coefficient across the FLGS model further reinforces the robustness of the finding, suggesting that, in the long run, increases in the unemployment rate do not adversely affect economic output in the case of South Africa.

Although the positive relationship between increases in unemployment rates and GDP growth can seem counterintuitive, in recent times, scholars[4] have suggested different factors that explain this phenomenon. Oner (2020) argues that unemployment does not fall in lockstep with an increase in growth. Higher output may be achieved by having the same number of employees doing more work as the companies try to recover from economic downturns. Also, structural unemployment may persist even during periods of strong economic growth because of skills mismatch, usually resulting from shifts in industry composition or technological advancement (Pettinger, 2019). Similarly, improvements in productivity due to automation can result in improved efficiency and subsequent higher output, accompanied at times by job displacements. Moreover, increasing the unemployment rate caused by more people entering the job market may coincide with GDP growth (Suma, 2017).

[4]Oner, 2020; Pettinger, 2019; and Suma, 2017.

Table 11. *Empirical Results for the FGLS Model*

	FGLS: Long run results					
Error structure across the panels	**Independent and Identically distributed (IID)**			**Heteroscedastic but uncorrelated**		
Form of Autocorrelation	Independent	AR(1)	Panel-specific AR(1)	Independent	AR(1)	Panel-specific AR(1)
Model	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr	ln_diffgdpr
diffunempr	0.0333***	0.0349***	0.0358***	0.00278*	0.00287*	0.00310**
	(4.130)	(4.205)	(4.289)	(1.851)	(1.824)	(1.961)
Constant	14.62***	14.62***	14.62***	14.64***	14.64***	14.64***
	(662.0)	(746.4)	(755.2)	(4,064)	(4,484)	(4,426)
Observations	602	602	602	602	602	602
Number of provinces	9	9	9	9	9	9
chi2 (Wald test)	17.05***	17.69***	18.40***	3.426*	3.327*	3.847**
z-stats in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Conclusion and Policy Implications

Conclusion

The empirical analysis of Okun's Law across the three baseline models, that is, the DFE, MG, and PMG, provides valuable insights into the relationship between changes in the unemployment rate and GDP growth in South Africa. In the short run, the baseline models showed mixed results, with DFE and MG suggesting a very small and statistically insignificant negative relationship between changes in unemployment rate and GDP growth, while the PMG indicated a statistically significant small positive relationship. In contrast, the long-run relationships highlighted a more consistent and statistically significant positive effect of unemployment rate increases on GDP growth.

The introduction of more advanced estimators, namely the PCSE and the FLGS, improved the robustness of the results by addressing challenges of heteroscedasticity, contemporaneous correlation, and endogeneity. Both the PCSE and FLGS models revealed a positive and statistically significant relationship between the change in the unemployment rate and GDP growth in the long run.

Overall, the results suggest that, while the short-run impact of unemployment on GDP is less clear, the long-run effects, as well as those estimated using more advanced econometric techniques, indicate a positive and significant relationship, debunking the relevance of Okun's Law in understanding the dynamics between unemployment and economic output. For instance, in the Northern Cape province, despite experiencing high economic growth, unemployment remains persistently elevated. This observation underscores the non-relevance of Okun's 1962 study, which was based on a model with only two factors of production, labour (L) and capital (K). In contrast, the modern production environment incorporates a third factor, artificial intelligence (AI), alongside labour and capital. Additionally,

labour in South Africa is inherently expensive, largely due to the influence of powerful trade unions. Also, in sectors such as mining, where deep and hazardous mines are now safely operated with the use of robotic technologies, the role of labour in the productive apparatus has significantly declined.

Therefore, the necessary economic policy orientation to address high unemployment rates and low GDP growth in South Africa should not be anchored on the intuitive inverse relationship of the two variables. Instead, a mixture of policies that directly and indirectly target unemployment and improved productivity should be implemented. Such policies should be deployed from both the demand side and the supply side. For example, the expansionary demand-side policies like increased government spending on infrastructure projects, public services, and social welfare programs can directly boost employment by creating jobs and increasing consumption. On the supply side, policies that seek to improve productivity, while at the same time making some labour market reforms to directly address unemployment, would help stabilise the economy. Therefore, to address the positive long-term relationship between unemployment and GDP growth highlighted in our study, policymakers should adopt a balanced approach that combines demand stimulation with structural reforms aimed at reducing unemployment. These efforts should be complemented by investments in human capital and incentives for private sector job creation to ensure sustained long-term economic growth.

Limitations

This study had its limitations, like any other study. Firstly, the study uses quarterly data from 2008 to 2024, which provides a relatively short time frame for testing Okun's Law. While this period covers various economic cycles, including the 2008 financial crisis and the subsequent recovery, it may not fully capture the long-term structural shifts or longer-term trends in the South African economy. Additionally, potential data quality issues or gaps in reporting across provinces could limit the accuracy of the results. Secondly, while the models applied in this study accounted for the provincial heterogeneity to some extent, the vast economic differences between provinces may still lead to biases in the estimation of Okun's coefficient. For instance, while the PMG model allows for different short-term dynamics, it assumes common long-term relationships across provinces, which may not always hold due to the provincial differences in labour markets and industrial sectors. Equally, the DFE model assumes time-invariant individual effects, which might not be true in the presence of rapidly changing economic conditions in South Africa.

Recommendations

We recommend that future studies extend the time frame of the study to include data before 2008 and provide a more comprehensive view of the long-term dynamics between economic growth and unemployment, especially in periods of economic stability and crises. Moreover, future studies should incorporate other relevant variables, such as AI, labour market policies, migration patterns, and provincial differences in education levels, to gain a more holistic understanding of

the factors influencing the relationship between GDP growth and unemployment. Further research could explore whether structural breaks have occurred in the relationship between economic growth and unemployment, especially due to the adoption of AI and automation, which might lead to job displacement in the mining and agricultural sectors of South Africa.

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World Economy in 2025 – Unprecedented Risks and Challenges

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The world macroeconomic climate has recently deteriorated, an evolution mainly determined by the high level of uncertainty. Uncertainty has become a new normal following the COVID-19 pandemic, the war in Ukraine, and geopolitical tensions in the Middle East, however, it increased sharply in the context of the economic policy decisions at the beginning of the Trump 2.0 Administration in the United States. The decision to increase the trade tariffs would hurt the world trade flows in the short-run and seriously impact the trust between major actors in the long-run. In this paper, we resort to the literature review and use standard econometric tools and the databases of several institutions in order to assess the relation between the investment climate, on the one hand, and world trade and the real financing costs, on the other hand, in the USA, and Germany during January 2005 – March 2025. The results express unfavourable prospects for the investment climate in the short-run, given the negative outlook for world trade, and the high level of the real financing costs.

Keywords: *world trade, investment climate, real financing costs, economic policy*

Introduction

The key objective of the present paper is to underscore the most important categories of risks undermining the macroeconomic climate globally. In our opinion, the investment climate, the world trade environment, and the real financing costs are crucial. These are correlated with the geo-political tensions at a high level (including events in the Middle East) and the protectionist tariff policy in the United States under the Trump 2.0 Administration, as well as long-term effects of the pandemic. One can remark also a combination of effects of the above-mentioned categories (for instance, intensification of volatility in international financial markets, high inflation, or higher-for-longer interest rates), eroding buffers, and structural challenges in various countries' public finances.

The world macroeconomic climate has recently deteriorated, an evolution determined by the intensification of the uncertainty to record high levels, following the structural changes in terms of trade policy announced by the United States, the largest economy in the world, with a nominal dimension of almost USD 30tn in 1Q 2025, according to the estimates of the Bureau of Economic Analysis (BEA, 2025).

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The global economic policy uncertainty index hit a record high level in 2025, according to the statistics available on the site of the Federal Reserve from Saint Louis (2025a). The persistence of the uncertainty at record high levels represents a poison for the confidence of the investors and of the consumers, with negative impact for the investment climate.

In the USA the consumer confidence indicator estimated by the University of Michigan (2025) deteriorated in the past months, towards the lowest level since the summer of 2022 (the period when the annual pace of the consumer prices accelerated to over 9.0%, the highest level since the 1980s).

Furthermore, the indicator measuring the business climate across the small businesses in the USA declined in the month of April toward the lowest level since October 2024, according to the indicator estimated by the National Federation of Independent Businesses (NFIB, 2025).

We underline that the recent intensification of the uncertainty is not the only factor with negative contribution for the investment climate. In the past quarters, there was noticed an upward trend for the real financing costs (nominal financing costs adjusted by inflation) in the long-run in the USA, a barometer for the financing costs in the world economy.

Considering the above-mentioned factors, we emphasize that the deterioration of the monthly macroeconomic indicators has not been limited to the US economy.

In China, the second largest economy in the world, with a nominal dimension converging towards USD 19tn in 2024, according to the estimates of the National Bureau of Statistics from Beijing (2025), the economic activity rose for the 18th month in a row in April, but the growth pace decelerated to the lowest since January, as reflected by the Caixin PMI Composite barometer, the statistics being available on the platform Trading Economics (2025).

Last, but not least, the economy of Euroland (which contributes by around 85% to the formation of the GDP of the European Union) resumed contraction in the month of May, according to the PMI Composite barometer estimated by S&P Global (2025a).

In this context, the growth pace of the world economic activity decelerated in the month of April 2025, being recorded the weakest pace since November 2023, according to the PMI (Purchasing Managers' Index) Composite (manufacturing and services) estimated by S&P Global (2025b).

In this paper standard econometric tools are implemented and the databases of several institutions are used in order to analyse the relation between the investment climate and the evolution of the world trade and of the real financing costs.

We worked with both monthly and annual data in order to assess this relation in the USA (the largest economy in the world), and in Germany (the locomotive economy of the European Union, with a nominal dimension of over EUR 4.3tn in 2024, according to the estimates of Eurostat (2025a)).

On the one hand, we estimated the trend components for these indicators by applying the filter developed by Hodrick-Prescott (1997).

On the other hand, we implement the standard OLS regression to estimate the impact the world trade and the real financing costs have on the investment climate.

The results show a positive relation between the evolution of world trade and the investment climate in both the USA and Germany.

Furthermore, there is a negative relation between the investment climate and the real financing costs in both economies.

The rest of the paper has the following structure: the literature review is briefly presented in the next section; the methodology is described in the third section; the main results are interpreted in the fourth section; the conclusions are drawn in the last section.

Literature Review

All recent reports from major international organizations highlight a number of risks with a profound impact on regional and global economic activity (IMF, 2025a; OECD, 2025; European Commission, 2025; WTO, 2025; Asian Development Bank, 2025). The US American First Policy, with its complex and various impacts (in trade, investment, energy, technology, international relations, to mention several of the relevant fields), is the most evident risk at present. At the same time, uncertainty is increasing, borrowing costs and inflation remain high, and confidence between states is sharply decreasing.

The protectionist stance by the Trump 2.0 administration has sharply accentuated the uncertainty in the global economy.

Although the sustained trade protectionism implies long-term structural changes such as supply chain reconfiguration, technological adaptation, or industrial policy realignments, the framework of this paper is too limited in order to capture its potential impact. The trade deals concluded until now between the United States and trade partners such as the United Kingdom (with tariffs of 10% for their exports to the American market), Japan (15%), the European Union (15%), the Philippines, Indonesia, and Vietnam (19% for the first two and 20% for the last mentioned member of the Association of the Southeast Asian Nations) underscore the US trade partners' inclination towards concessions. The losses in terms of competitiveness are evident for the US trade partners. Commitments of the EU as a whole in terms of large investments in the United States indicate a new trend, namely that of replacing a part of the trade flows by direct production in the US, however that might be tempered by the decision makers in the private sector, who might incline towards strengthening cooperation with other partners, less protectionist than the US at present.

Asian Development Bank (2025) synthesizes the current situation as follows: ***"risks mount as tariffs escalate"***. Elevated financial risks are also present, leading to higher borrowing costs. Among the looming risks are negative spillover from the evolving geoeconomic and geopolitical situation as well as a potential disruption to oil export routes. In our opinion, the global trade war is at present the highest challenge of all.

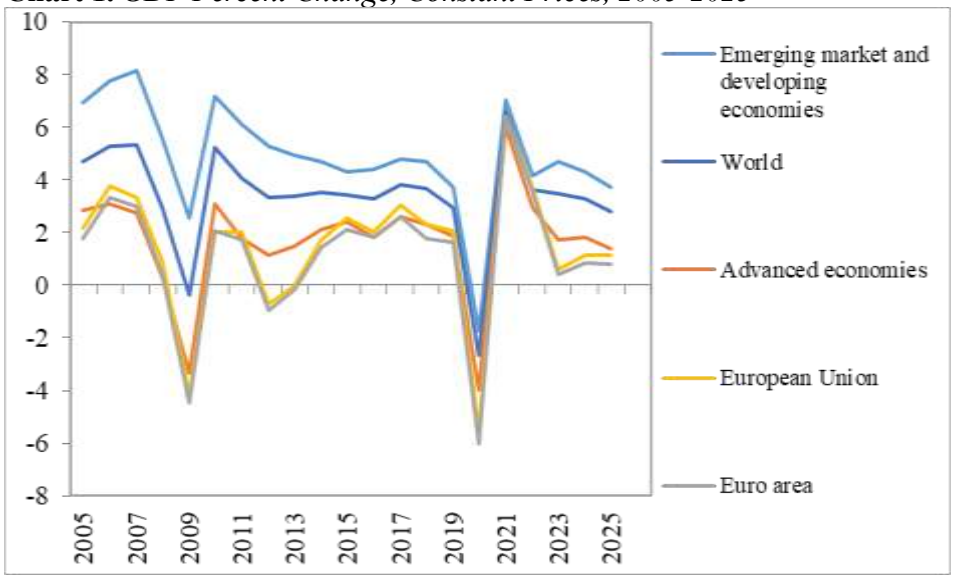
The US administration's decision on April 2, 2025, to increase tariffs has contributed to heightened trade tensions and led to an increase in uncertainty to levels not seen in decades. The global economy is currently facing a new major

test, after being affected over the past five years by the Covid-19 pandemic (the most severe global health crisis in the last century), the paradigm shift from a geopolitical perspective, and their consequences, including the inflationary surge that prompted central banks to significantly increase key interest rates. The intensification of uncertainty has an unfavourable impact on investor and consumer confidence and immediate implications for economic and financial stability, both in developed countries and in emerging and developing countries.

In this context, the IMF experts have revised downward their forecasts for the annual growth rate of international trade (with unfavourable implications for global economic activity) and upward their forecasts for annual consumer price dynamics in 2025 (IMF, 2025a; 2025b).

Thus, in the macroeconomic scenario recently updated by the IMF, global GDP is forecast to grow at a yearly rate of 2.8% in 2025, revised downward by 0.5 percentage points. The following Chart reflects the GDP growth rates at global level, in the two major groups of countries (developed and developing/emerging), as well as in the EU and the Eurozone.

Chart 1. *GDP Percent Change, Constant Prices, 2005-2025*



Source: Authors' representation, based on IMF (2025b).

This revision was driven by the estimated impact of new tariffs, as well as the consequences of the wave of uncertainty. The volume of international trade in goods and services is estimated at a yearly rate of only 1.7% in 2025, revised downwards by 1.5 percentage points.

In his second term as President, Donald Trump continues the policies from his first term in office (from 2017 to 202), including his 'America First' policy – with higher tariffs, subsidies and fierce competition (Stehrer, 2024). His approach is even more assertive, as demonstrated by his executive orders (The White House, 2025).

The latest report by the World Trade Organization (WTO, 2025) shows that global trade in goods is expected to decline by 0.2% in 2025 after a growth rate of 2.9% in 2024. Moreover, if tariff policies become even more protectionist, the

decline could be even more drastic, reaching 1.5%, as uncertainty surrounding trade policy could be "a brake on global growth".

The OECD estimates ***"suggest that in the medium-term global trade volumes should fall by close to 2% when the United States raises bilateral tariff rates by 10 percentage points on imports from all trading partners and all countries retaliate by raising bilateral tariff rates on imports from the United States by 10 percentage points. In all, such tariff changes affect approximately 8.2% of total world trade in goods and services. At the sectoral level, trade would fall relatively sharply in many manufacturing sectors, particularly motor vehicles and parts and machinery and equipment"***. Overall, consumers face much of the burden of higher tariffs, with household real incomes estimated to decline, while productivity is also forecast to be strongly affected (OECD, 2025).

According to IMF, ***"tariffs are a negative supply shock for the economy imposing them, as resources are reallocated toward the production of noncompetitive goods, with a resulting loss of aggregate productivity, lower activity, and higher production costs and prices. Moreover, in the medium term, by reducing competition, tariffs increase the market power of domestic producers, decrease incentives to innovate, and create multiple opportunities for rent seeking. For trading partners, tariffs constitute mostly a negative external demand shock, driving foreign customers away from their products, even if some countries could benefit from the rerouting of trade flows"*** (IMF, 2025a). Nevertheless, fiscal support in some cases (for instance, China, Eurozone) offsets some of the negative growth impact (IMF, 2025a).

The April 2, 2025 is the date proclaimed by President Trump as "Liberation Day", which he considers the day of the "declaration of economic independence" of the United States, with the following stated objectives:

1. pursuing reciprocity to rebuild the economy and restore national and economic security;
2. taking back national economic sovereignty;
3. reprioritizing U.S. manufacturing, as increased domestic production is essential to U.S. national security;
4. addressing trade imbalances.

However, the negative effects for businesses and consumers are evident, and it can be prefigured inflation rise, potential input shortages, lower employment and output. On the official White House website, the fact sheet on the declaration of national emergency states that "foreign trade and economic practices have created a national emergency", which imposes response tariffs to strengthen the US international economic position and protect American workers.

According to the White House, the motivations for increasing tariffs are the following. "Large and persistent annual U.S. goods trade deficits have led to the hollowing out of our manufacturing base; resulted in a lack of incentive to increase advanced domestic manufacturing capacity; undermined critical supply chains; and rendered our defence-industrial base dependent on foreign adversaries". Main tariffs invoked are: Section 301 tariffs that seek to tackle the unfair trade practices

and Section 232 tariffs related to national security concerns (mainly on steel, aluminium, and automobiles).

The data reflect a tripling in the monthly value of the U.S. trade deficit over the past 10 years, from about $40 billion in January 2015 to $131 billion in January 2025 (Chart 2). Since 2020, each year the average monthly deficit has exceeded $50 billion, approaching $80 billion in 2022, before falling to $65 billion in 2023 and rising to $76 billion in 2024 (Chart 2).

Chart 2. *Evolution of the US Trade Balance, Trade in Goods and Services, March 1992-March 2025 (in USD billions, monthly values)*

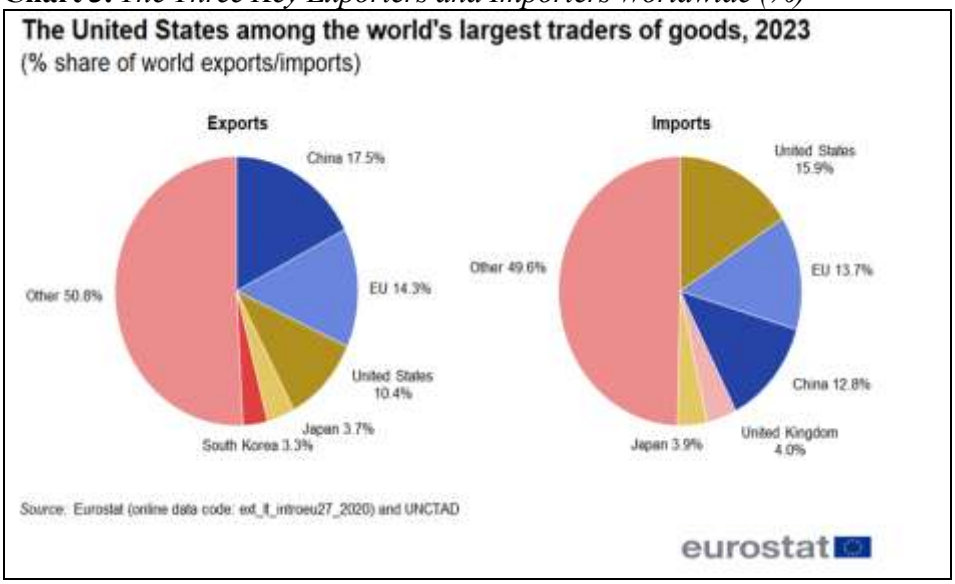
Source: Authors' representation, based on Federal Reserve Bank of St. Louis (2025b).

President Trump has invoked his authority under the International Emergency Economic Powers Act of 1977 (IEEPA). Consequently, there were imposed "basic" tariffs on all imports into the US. The level was set at 10% and took effect from April 5. Imports from a number of countries are subject only to basic duties, namely the UK, Singapore, Brazil, Australia, New Zealand, Turkey, Colombia, Argentina, El Salvador, the United Arab Emirates and Saudi Arabia (The White House, 2025).

Specific ("personalized", individualized) reciprocal tariffs were also imposed on about 60 of the "biggest offenders" (meaning countries with which the US has the biggest trade deficits). Initially these should have taken effect from April 9, however with the exception of China, the others have been postponed in order to stimulate negotiations on a bilateral basis. Among the main trading partners subject to these tariffs are: the European Union (with an initial level of 20%, reduced to 15%), China (faced by an evident escalation of a trade war in April, followed by de-escalation in May), Vietnam (initially 46%, later reduced to 20%), Thailand (36%), Japan (24%, reduced to 15% after negotiations), Cambodia (49%), South Africa (30%) and Taiwan-China (32%) (The White House, 2025). China is the first target of the global trade war initiated by the US in April 2025 (with collateral victims, including here the Asian Tigers). The EU is the second major target (Oehler-Șincai, 2025). China and the EU are the first and

the second largest exporters worldwide, followed by the US, while the EU and China are the second and the third largest importers, as shown in the following Chart.

Chart 3. *The Three Key Exporters and Importers Worldwide (%)*



Source: Eurostat (2025b).

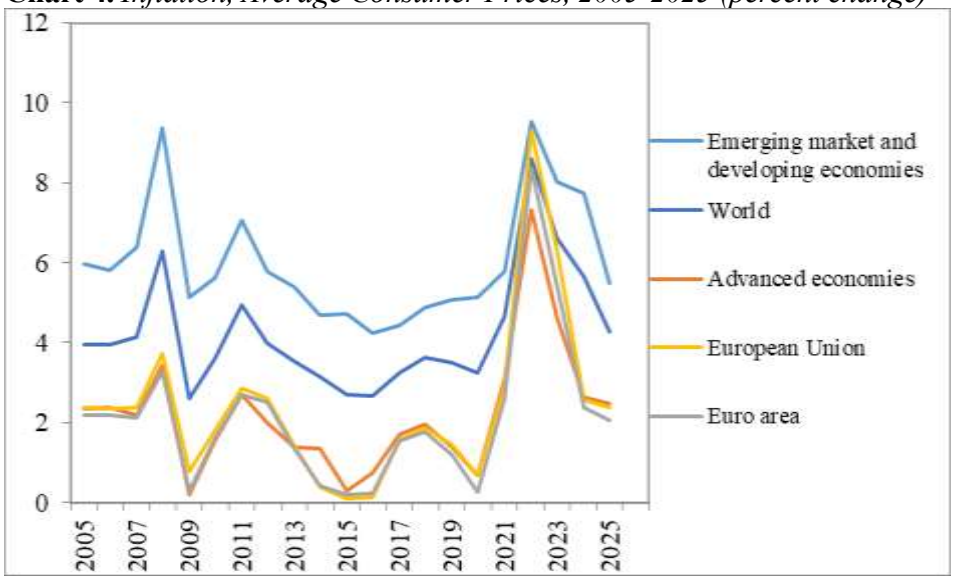
In recent weeks, the US has launched negotiations with 18 of its major trading partners, as these are considered very important for the United States. These are not free trade agreements in the classic, traditional sense, but rather a basis for easing trade tensions. However, uncertainty remains for businesses, consumers, and investors alike.

On May 8, a first deal, with the United Kingdom, was announced. Under the agreement between the US and the UK, most goods imported by the US will continue to be subject to a basic customs duty of 10%. However, the US president believes that the UK has "made a good deal," given that the 10% rate remains the lowest that will be applied by the US, and many other trading partners will face much higher final customs duties (Wingrove et al., 2025).

On the one hand, the escalation of protectionism on the part of the US has led to intensified negotiations between other partners towards the liberalization of their trade. On the other hand, it has given the US an advantageous position in negotiations with both allies and adversaries. An argument in support of the first statement above is as follows. On May 6, the UK concluded a free trade agreement with India, considered "the biggest trade deal since Brexit." Negotiations had been launched in January 2022, with trade tensions with the US stimulating the conclusion of an agreement. In fact, since leaving the EU on January 31, 2020, the UK has made considerable efforts to strengthen/expand trade relations with its major partners.

As regards inflation, the IMF estimates reflect a general decreasing trend (IMF, 2025b), as long as the highest announced tariffs are not implemented, but kept as a negotiation tool.

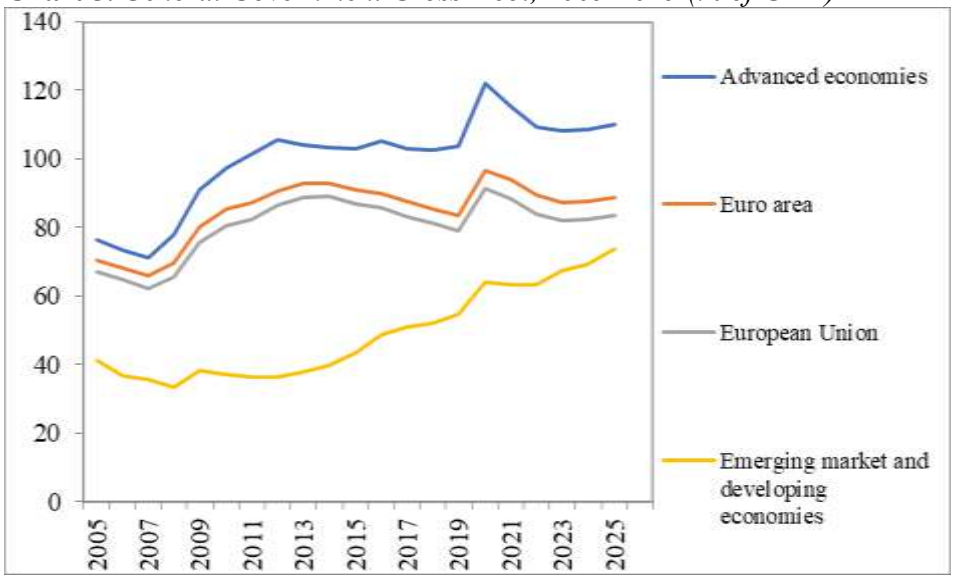
Chart 4. *Inflation, Average Consumer Prices, 2005-2025 (percent change)*



Source: Authors' representation, based on IMF (2025b).

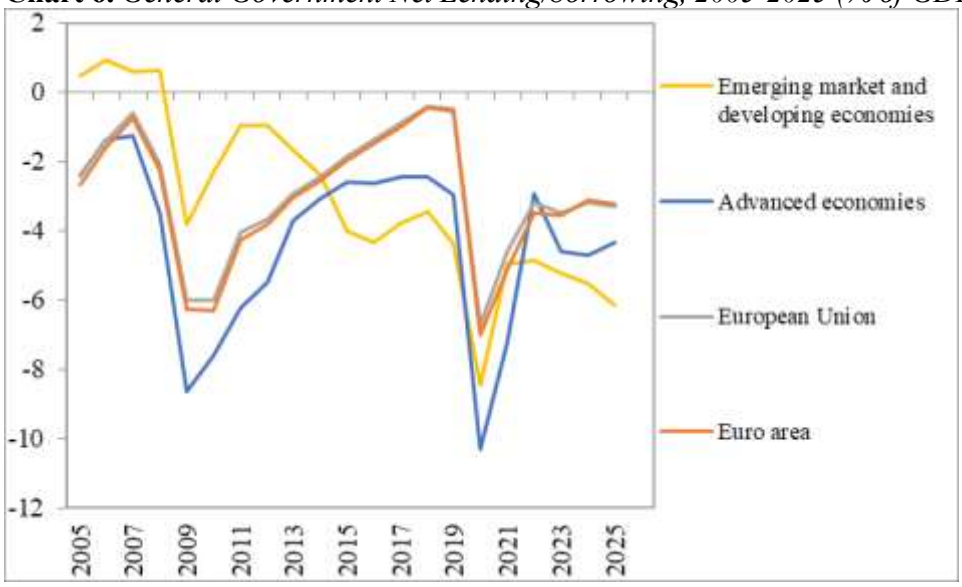
According to IMF (2025a; 2025b), a significant risk facing all the countries worldwide is the rising debt, in the context of lower growth and rising financing costs. Besides, new spending pressures accentuate the fiscal fragility. Emerging market and developing economies are most affected, both in terms of debt and fiscal deficit (Charts 5 and 6).

Chart 5. *General Government Gross Debt, 2005-2025 (% of GDP)*



Source: Authors' representation, based on IMF (2025b).

Chart 6. *General Government Net Lending/borrowing, 2005-2025 (% of GDP)*



Source: Authors' representation, based on IMF (2025b).

Methodology

In this paper, we implement standard econometric tools (the HP filter and OLS regression). The main goal is to estimate the relationship between the investment climate, on the one hand, and the evolution of international trade in goods and long-run financing costs, on the other hand, in the USA and Germany.

We worked with both monthly and annual data from several sources: International Monetary Fund (the annual pace of international trade) (IMF, 2025b), Netherlands Bureau for Economic Policy Analysis (the annual rate of international trade in goods) (CPB, 2025), Federal Reserve of Saint Louis (the 10-YR real financing costs, and the indicator measuring the business climate in the New York region) (FED St Louis, 2025c), Bureau of Economic Analysis (the annual pace of the gross fixed capital formation in the USA) (BEA, 2025), Destatis (the annual rate of the gross fixed capital formation in Germany) (Destatis, 2025), and IFO Institute from Germany (the indicator measuring the business climate in the largest economy in Europe) (IFO, 2025).

In this paper, all the econometric estimates were done by using the EViews software.

First of all, we estimated the trend components for the following indicators: the annual pace of world trade, the annual rate of world trade in goods, the business climate in the New York region, the business climate in Germany, and the 10-YR real financing costs in the USA (a benchmark for the financing costs in the world economy).

To estimate the trend component for the above-mentioned indicators, we applied the Hodrick-Prescott filter, one of the most widely used methods in the literature to distinguish between the structural and cyclical components of macroeconomic variables.

This simple and transparent method is best described by the following relation:

$$\textbf{Min} \sum_{t=1}^{T} (\ln Y_t - \ln Y_t^*)^2 + \lambda \sum_{t=2}^{T-1} ((\ln Y_{t+1}^* - \ln Y_t^*) - (\ln Y_t^* - \ln Y_{t-1}^*))^2 \quad (1),$$

in which Y_t, Y_t^* and λ represent the macroeconomic indicator, its trend, and a smoothness parameter.

In this paper we used values for this smoothness parameter of 100 when working with annual data, and 14400 while working with monthly observations, as recommended by the developers of this filter.

On the other hand, we used the trend component of the indicators and estimated several OLS regressions, as described in the following lines.

While working with monthly observations we estimated two OLS regressions for the period January 2005 – March 2025:

A. NYBCTR =C(1)+ C(2)*WTGTR+C(3)*USRFCTR (2),

where NYBCTR is the trend component of the indicator measuring the business climate in the New York region, WTGTR represents the trend component for the international trade in goods, while USRFCTR is the trend component for the 10-YR real financing costs in the USA;

B. DEBCTR=C(1)+C(2)*WTGTR+C(3)*USRFCTR (3),

in which DEBCTR represents the trend component of the indicator measuring the business climate in Germany (we used the IFO indicator), WTGTR is the trend component for the international trade in goods, while USRFCTR represents the trend component for the 10-YR real financing costs in the USA.

While working with annual data we estimated two OLS regressions for the period 1992 – 2024:

A. USGFCFTR = C(1)+C(2)*WTTR+C(3)*USRFCTR (4),

where USGFCFTR represents the trend component for the annual pace of the gross fixed capital formation in the USA, WTTR is the trend component for the annual rate of world trade, and USRFCTR is the trend component for the 10-YR real financing costs in the USA;

B. DEGFCFTR = C(1)+C(2)*WTTR+C(3)*USRFCTR (5),

in which DEGFCFTR represents the trend component for the annual pace of the gross fixed capital formation in Germany, WTTR is the trend component for the annual rate of world trade, and USRFCTR is the trend component for the 10-YR real financing costs in the USA.

Interpretation of the Results

According to the results (represented in the following tables), there is a positive relation between the business climate in the New York region and the international trade in goods (trend components), the estimated coefficient being 3.52. In other words, the advance of the international trade in goods by 1% Y/Y contributed to the increase of the indicator measuring the business climate in the New York region by 3.52 points during the period January 2005 – March 2025.

On the other hand, the econometric results show a negative relation between the business climate in the New York region and the 10-YR real financing costs in the USA (trend components), the estimated coefficient being -12.44. Therefore, the increase of the long-term real financing costs in the USA by 1pp determined the decline of the indicator measuring the business climate in the New York region by 12.44 points during the interval January 2005 – March 2025, as can be noticed in the following table (Table 1).

Table 1. *The Results of the OLS Regression in the USA, Monthly Data*

Dependent Variable: NYBCTR
Method: Least Squares
Date: 06/01/25 Time: 14:08
Sample(adjusted): 2005:01 2025:03
Included observations: 243 after adjusting endpoints
NYBCTR =C(1)+ C(2)*WTGTR+C(3)*USRFCTR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	9.978613	0.681580	14.64042	0.0000
C(2)	3.524513	0.186209	18.92773	0.0000
C(3)	-12.44688	0.630411	-19.74407	0.0000
R-squared	0.684825	Mean dependent var		7.357687
Adjusted R-squared	0.682198	S.D. dependent var		9.934846
S.E. of regression	5.600663	Akaike info criterion		6.295916
Sum squared resid	7528.181	Schwarz criterion		6.339040
Log likelihood	-761.9538	Durbin-Watson stat		0.004588

Source: Authors' representation based on the results of the OLS regression generated by the implementation of the EViews software based on the methodology described above

In the case of Germany, the results show a positive relation between the indicator measuring the business climate (IFO) and the evolution of the international trade in goods (trend components) - estimated coefficient at 0.56 during January 2005 – March 2025. In other words, the advance of the international trade in goods by 1% Y/Y contributed to the increase of the indicator measuring the business climate in Germany by 0.56 points in this period.

However, there can be noticed a negative relation between the indicator measuring the business climate in Germany (IFO) and the evolution of the 10-YR real financing costs in the USA (trend components) in the interval January 2005 – March 2025, the estimated coefficient being -3.94. In other words, the increase of the long-term real financing costs in the USA by 1pp determined the decline of the indicator measuring the business climate in Germany by 3.94 points during the period January 2005 – March 2025, as reflected in Table 2.

Table 2. *The Results of the OLS Regression in Germany, Monthly Data*
Dependent Variable: DEBCTR
Method: Least Squares
Date: 06/01/25 Time: 14:08
Sample(adjusted): 2005:01 2025:03
Included observations: 243 after adjusting endpoints
DEBCTR=C(1)+C(2)*WTGTR+C(3)*USRFCTR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	98.00912	0.427550	229.2345	0.0000
C(2)	0.558026	0.116807	4.777315	0.0000
C(3)	-3.940273	0.395452	-9.963976	0.0000
R-squared	0.293114	Mean dependent var		95.73812
Adjusted R-squared	0.287223	S.D. dependent var		4.161332
S.E. of regression	3.513251	Akaike info criterion		5.363229
Sum squared resid	2962.304	Schwarz criterion		5.406354
Log likelihood	-648.6324	Durbin-Watson stat		0.002496

Source: Authors' representation based on the results of the OLS regression generated by the implementation of the EViews software based on the methodology described above

On the other hand, the results of the econometric analysis developed by employing annual observations are represented in the following tables.

In the case of the USA there is a negative relation between the gross fixed capital formation and the world trade (for the trend components), an estimated coefficient of -0.98 for the period 1992 – 2024. This, in turn, can be explained by the fact that the openness degree of the US economy is very low, around 25%, according to the platform TheGlobalEconomy (2025).

Furthermore, in the case of the USA the results of the econometric analysis point to a positive relation between the gross fixed capital formation and the long-term real financing costs (for the trend components), with an estimated coefficient of 2.65 during the period 1992 – 2024, as reflected in the following table. This result is counterintuitive, as the increase of the real financing costs is normally negative for the investments.

Table 3. *The Results of the OLS Regression in the USA, Annual Data*
Dependent Variable: USGFCFTR
Method: Least Squares
Date: 06/03/25 Time: 10:15
Sample(adjusted): 1992 2024
Included observations: 33 after adjusting endpoints
USGFCFTR = C(1)+C(2)*WTTR+C(3)*USRFCTR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	4.024151	0.573605	7.015549	0.0000
C(2)	-0.979819	0.200466	-4.887702	0.0000
C(3)	2.650079	0.342571	7.735856	0.0000
R-squared	0.725573	Mean dependent var		3.524245
Adjusted R-squared	0.707277	S.D. dependent var		1.651286
S.E. of regression	0.893409	Akaike info criterion		2.698964
Sum squared resid	23.94539	Schwarz criterion		2.835010
Log likelihood	-41.53290	Durbin-Watson stat		0.154704

Source: Authors' representation based on the results of the OLS regression generated by the implementation of the EViews software based on the methodology described above

However, in the case of Germany, the econometric analysis shows a positive relation between the gross fixed capital formation and world trade (trend components), with an estimated coefficient of 0.47 during the period 1992 – 2024. In other words, the increase of world trade by 1% Y/Y contributed to the advance of the gross fixed capital formation by 0.47pp in the interval 1992 – 2024.

On the other hand, there is a negative relation between the gross fixed capital formation in Germany and the long-term real financing costs in the USA (trend components), with an estimated coefficient of -0.99 for the period 1992 – 2024. In other words, the increase of the long-term real financing costs in the USA by 1pp contributed to the decline of the gross fixed capital formation in Germany by almost 1pp in the analysed interval, as can be noticed from Table 4.

Table 4. *The Results of the OLS Regression in Germany, Annual Data*

Dependent Variable: DEGFCFTR
Method: Least Squares
Date: 06/01/25 Time: 14:17
Sample(adjusted): 1992 2024
Included observations: 33 after adjusting endpoints
DEGFCFTR = C(1)+C(2)*WTTR+C(3)*USRFCTR

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.170944	0.506139	0.337741	0.7379
C(2)	0.474866	0.176888	2.684556	0.0117
C(3)	-0.988220	0.302278	-3.269239	0.0027
R-squared	0.267221	Mean dependent var		0.897639
Adjusted R-squared	0.218370	S.D. dependent var		0.891675
S.E. of regression	0.788328	Akaike info criterion		2.448704
Sum squared resid	18.64385	Schwarz criterion		2.584750
Log likelihood	-37.40361	Durbin-Watson stat		0.097674

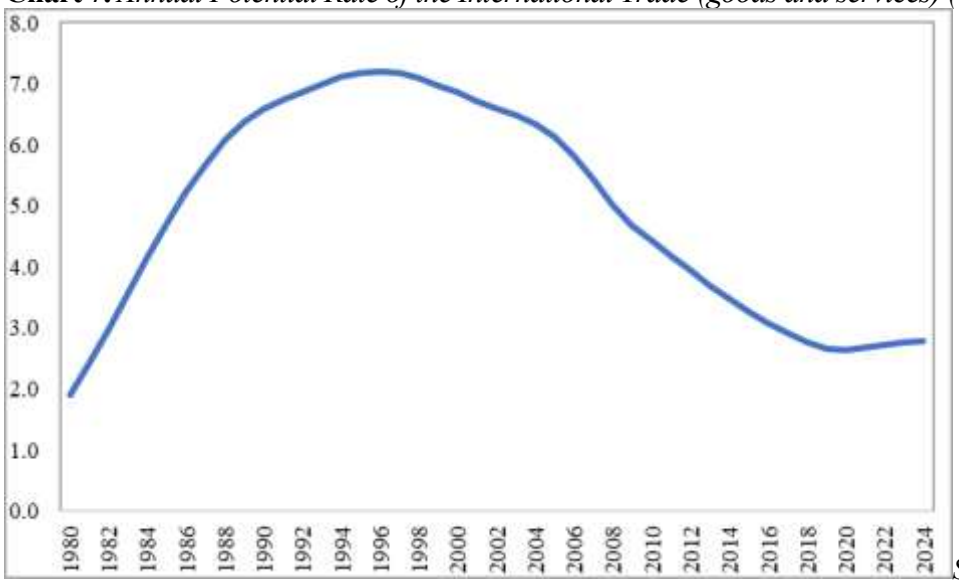
Source: Authors' representation based on the results of the OLS regression generated by the implementation of the EViews software based on the methodology described above

Conclusions

The recent changes in terms of trade policy in the USA would have a negative impact for the evolution of world trade in goods and overall, for the international trade (goods and services) in the coming quarters. While the USA imposes tariffs for trade in goods, the EU (with a significant deficit in trade in services with the USA) may retaliate also in the field of trade in services.

Unless negotiations among the main economic blocks in the world intensify, in order to remove the tariffs announced by the USA since the beginning of the year, there is the risk for the annual potential rate of the international trade to deteriorate to record low levels in the coming years in our view. In fact, according to our econometric estimates this indicator is already close to the lowest levels since the beginning of the 1980s, as can be noticed in the following chart.

Chart 7. *Annual Potential Rate of the International Trade (goods and services) (%)*



Source: Authors' representation, based on the results of the econometric estimates

The negative outlook for world trade corroborated with the high level of the real financing costs in the largest economy in the world (a benchmark for the financing costs in the world economy) express unfavourable prospects for the evolution of the investments in the real side of the economy in the coming quarters, either in the USA or in Germany, according to the results of the econometric analysis developed in this paper.

In this respect, we point out that the results of the analysis with annual data express the fact that investment flows would be more severely hit in Germany than in the USA, as the openness degree in the largest economy in the world is lower.

On the other hand, we emphasize that the recent measures announced at the EU level (including the Competitiveness Compass and the ReArm EU program) may counterbalance the impact of the changes in trade policy in the USA in the case of the German economy.

Therefore, as a future research direction we identify the assessment of the impact of the changes in terms of trade policy in the USA, but also the impact of the retaliatory measures, either in the EU, or in China. The trade deals already reached by the United States with the United Kingdom, Japan and other Asian countries, as well the EU limit the margin of retaliation. However, uncertainty and lack of trust among relevant trade partners persist.

The main limitation of this analysis is the extrapolation of the case study results to the whole world economy. Other similar case studies could strengthen the study results.

The results of this analysis are relevant for the policymakers in the world. The US protectionism has not cancelled the commitment of other major players to multilateralism. Both developed and developing/emerging economies (including the ten members and partners of the BRICS – Brazil, Russia, India, China, and South Africa) remain committed to multilateralism, the international cooperation in terms of trade, investments, and development. These elements are essential for durable peace, improvement of prosperity, and a sustainable planet in the long-run.

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