

**Les membres du jury qui ont évalué
ce mémoire ont demandé des
corrections mineures.**

CATASTROPHE COVERAGE IN FLORIDA: EXAMINING CITIZENS ROLE AND MARKET IMPACT

By

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Abstract

Florida's homeowners insurance market has suffered drastic setbacks in the last few years because of climbing property values, increasing hurricane frequency, and the collective exiting of private insurers, which has led to Citizens Property Insurance Corporation (Citizens) becoming the largest insurer in the state. The thesis explores premium differences between Citizens and private insurers, insurance affordability based on household income, and the financial impact of Citizens potentially serving as Florida's sole residential insurer. Based on QUASR county-level data from 2009-2019 and regression analyses, the results indicate that Citizens consistently charges lower premium rates reflective of its affordability mandate, while much of the private insurance market runs above affordability thresholds, particularly in the high-risk counties. But both Citizens and for-profit insurers demonstrate a cross-subsidization bias, although the latter do this more aggressively when it comes to lowering premiums for wealthier households and high-risk properties. However, various scenarios and time-series forecasting drive home the fact that, while Citizens could remain affordable short term, monopolizing the market would massively increase financial exposure to extreme loss events and vulnerabilities. The findings highlight critical trade-offs between affordability and financial stability in Florida's insurance market.

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List of Abbreviations

AIC – Akaike Information Criterion

ACS – American Community Survey

ARIMA – Autoregressive Integrated Moving Average

CA – Coastal Account

Citizens – Citizens Property Insurance Corporation

CLA – Commercial Lines Account

FHFA – Federal Housing Finance Agency

FEMA – Federal Emergency Management Agency

FIGA – Florida Insurance Guaranty Association

FLOIR – Florida Office of Insurance Regulation

FHCF – Florida Hurricane Catastrophe Fund

FWUA – Florida Windstorm Underwriting Association

GIS – Geographic Information System

HHI – Household Income

HPI – Housing Price Index

HW-2 – Homeowners Wind-only

JUA – Florida Residential Property and Casualty Joint Underwriting Association

NAIC – National Association of Insurance Commissioners

NFIP – National Flood Insurance Program

NRI – National Risk Index

OLS – Ordinary Least Squares

PLA – Personal Lines Account

QUASR – Quarterly and Supplemental Reporting System

ZHVI – Zillow Home Value Index

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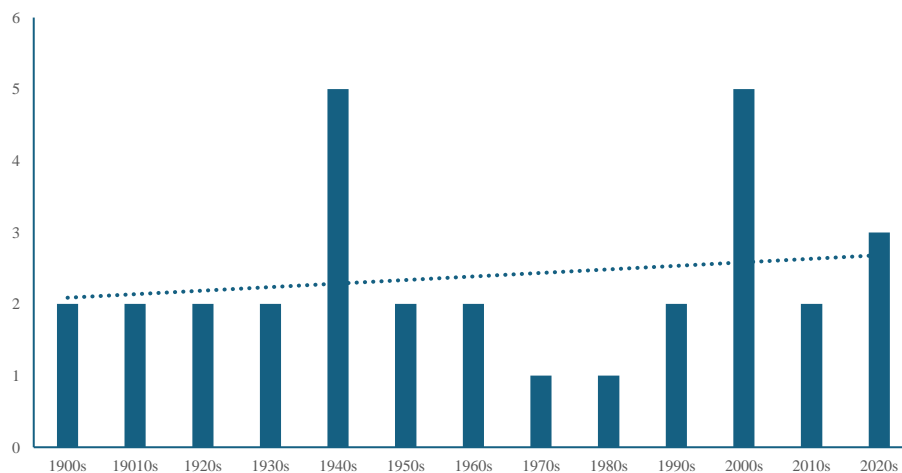
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1. Introduction

Florida's homeowners insurance market is in dire straits, pushed by the increasing intensity of hurricanes. Figure 1 illustrates the count of major hurricanes making landfall in Florida, broken down by decade from 1900 through 2024. Hurricane activity may ebb and flow, but the trendline tells an unequivocal story of storms becoming stronger, and Florida getting them more frequently in their lifetime. Add to that skyrocketing property values and increasing numbers of people moving into flood-prone properties, and insuring homes has become more difficult than ever.

Figure 1: Number of Major Florida Hurricanes, 1900-2024



Note: The Figure above shows the number of major hurricanes (Category 3 or 4) that impacted Florida between.
Source: Spencer (2024)

Over the last two decades, hurricanes have resulted in significant financial losses, the combined damages from big storms like Ian, Irma and Andrew have exceeded \$290 billion (Harrington, 2023). Many private insurers have left the state because of this, leaving behind smaller, less well-funded firms that find it difficult to strike a balance between cost and the financial risks associated with extreme weather disasters like hurricanes. As a result, a lot of Floridians have resorted to the state-backed Citizens Property Insurance Corporation

(Citizens), which has become the biggest insurer in the state, with over 1.3 million active policies as of September 2024—three times its number of active policies just five years ago (Buchwald,2024).

Citizens, originally introduced as an insurer of last resort, now faces mounting pressures as its market share expands. These pressures arise from multiple dimensions. First, the capped increases on premiums, mandated by state law, prevent Citizens from pricing its policies in line with the increasing risks of climate-driven catastrophes, which has widened the disparity between its premiums and those of private insurers. In 2022, for instance, Citizens premiums were, on average, 44 percent lower than those of private insurers. Moreover, this gap has more than doubled due to higher price hikes approved for private insurers in 2023 (Hudson,2024). Second, because of its growing policyholder base Citizens is exposed to higher financial risk, as its reserves might be insufficient to cover claims in the event of a major hurricane. Governor Ron DeSantis warns that Citizens is “not solvent”, and that state might need to step in with federal help if Citizens is unable to fulfill its claims commitments. Third, if claims exceed Citizens reserves, Florida law permits the imposition of surcharges not only on its policyholders but also on other insurance policyholders across the state, creating widespread financial strain on Floridian households. As noted by the Senate Budget Committee, such surcharges are unlikely to fully recoup losses, raising concerns about contingent liabilities and the potential need for federal bailouts (Buchwald,2024).

Citizens has made efforts to reduce its exposure through depopulation programs and has seen some success, as evidenced by a recent drop in the number of policies held by Citizens. Depopulation programs require private insurers to seek approval from state regulators to take over policies from Citizens, in turn reducing the latter’s risk exposure. To encourage this process, lawmakers recently approved a policy change which requires Citizens policyholders to accept offers of coverage from private insurers if the offers are within 20 percent of the cost

of Citizens premiums (Team, 2023). For instance, if a homeowner receives an offer from a private insurer that is 19 percent more than the Citizens premium, then they are mandated to accept it. On the other hand, if the offer exceeds the 20 percent threshold, the homeowner can choose not to switch to the private insurer.

While Citizens has reduced its policy count through depopulation programs, it is uncertain whether this trend will continue in the long run. Many private insurers in Florida exit the market due to insolvency or unsustainable claims cost following severe storms. This raises concerns about whether enough private insurers will remain to support depopulation efforts and absorb policies from Citizens in the future. Adding to this challenge, government-imposed caps on premium increases prevent private insurers from adjusting their rates to reflect the true risk of insuring high-risk properties. This misalignment between premiums and risk weakens the financial stability of private insurers, driving dissatisfaction among private insurers and prompting further market exits (Buchwald, 2024). The combination of these factors raises the question can Citizens effectively balance affordability and financial stability if it were to become Florida's sole residential insurer?

Three dimensions of Florida's insurance market—(1) the premium-setting behavior of Citizens compared to private insurers, (2) the affordability of premiums relative to median household income (HHI) across counties, and (3) the financial viability of Citizens increasing its market share from 17 percent to 100 percent—are investigated to address this question. In pursuit of these aims, this thesis uses a two-part analysis consisting of a regression model and time-series forecasting.

The first section focuses on premium differences and risk allocation. Using the Florida Office of Insurance Regulation's (FLOIR) Quarterly and Supplemental Reporting System (QUASR), the study uses Ordinary Least Squares (OLS) regression to evaluate how Citizens

and the private insurers' premiums charged vary with median HHI, house values, and hurricane exposure. The study compares Homeowners Wind-only (HW-2) policies because they provide coverage specifically for hurricanes and examines the extent to which Citizens lower premiums are the result of cross-subsidization of properties at higher risk. A second regression model evaluates the impact of hurricanes on premiums, using lagged hurricane indicators to quantify the differential pricing behavior of Citizens and private insurers post-disaster.

The second part projects the financial and affordability implications of Citizens becoming the sole insurer in Florida. Using historical data on premiums, policies, and loss distributions, the study forecasts premiums and demand over the next decade under two scenarios: (1) Citizens maintaining its current market share alongside private insurers and (2) Citizens assuming a monopoly position. Premium forecasting incorporates two methods: a baseline scenario using ARIMA time-series modeling and an alternative glide path scenario reflecting statutory premium caps. The resulting forecasts are used to estimate affordability levels—defined as premiums exceeding 8 percent¹ of median HHI—and to calculate financial shortfalls, highlighting the trade-offs between affordability and financial resilience.

Preliminary findings reveal that Citizens premiums remain below the affordability threshold in most counties, aligning with its mandate to provide accessible insurance. However, projections under the glide path scenario indicate that premiums could surpass this threshold by 2026, raising concerns about affordability for policyholders in high-risk areas. Furthermore, the study highlights an increase in financial vulnerability if Citizens becomes the sole insurer, with loss distributions displaying a heavy right tail indicative of heightened exposure to extreme loss events.

¹ Affordability thresholds are defined as four weeks of gross household income, or approximately 8 percent of median household income (Paddam, Liu, & Philip, 2023).

While the findings reveal valuable trends, they are not without limitations. The study relies on historical data and assumes that past patterns will persist, which may understate the future impacts of climate change or evolving market dynamics. Additionally, simplifying assumptions, such as inelastic insurance demand and the use of aggregate data, limit the granularity of the analysis. These limitations mean the results should be interpreted as a starting point for deeper investigations rather than definitive conclusions.

The structure of the thesis is as follows: Section 1 outlines the context, aim, and importance of the study. Section 2 describes relevant literature on affordability, risk sharing, and financial sustainability. Section 3 gives an overview of Citizens and its role in Florida's insurance market. Data sources and variables are discussed in Section 4, whereas Section 5 outlines the regression and forecasting methods used. Final results are shown in Section 6. Section 7 finally ends the paper with conclusions, limitations, and future works.

2. Literature Review

Increasing climate concerns and a rising resilience on public insurers have put Florida's homeowners insurance market at a crossroads. Citizens serve as the state's residual market insurer, providing coverage to policyholders who are unable to access private market insurance. To establish the groundwork for the analysis in this thesis, this literature review summarizes important studies on disaster risk financing, public-private partnerships, affordability, and catastrophe insurance.

Several studies have highlighted the unique challenges faced by Florida's insurance market. Kousky and Medders (2024) offer a comprehensive analysis of the evolution of Florida's public-private approach to property insurance. The study explains how, in the aftermath of Hurricane Andrew, Florida is experiencing its hardest market conditions, with private market availability shrinking and premiums rising significantly above the national average. Since 2019, 10 private insurers have gone insolvent, further reducing the availability of private insurance. The study's policy review explains how the combination of Citizens, the Florida Hurricane Catastrophe Fund (FHCF), and the Florida Insurance Guaranty Association (FIGA) has created a complex system for managing such extreme catastrophic risks. Among these, Citizens has emerged as the preferred option for many homeowners.

The study further underscores that Citizens premium are approximately 60 percent below the actuarial pricing levels, meaning that they do not accurately reflect the actual risk. The authors warn if Citizens continue to grow and provide insurance at a subsidized rate it would lead to financial risk in the future. They caution that simultaneous post-disaster borrowing by all three state-backed entities could lead to a debt crisis and dramatically increase premiums across Florida.

On a related note, Nicholson et al. (2020) presents an in-depth analysis of Citizens exposure and depopulation strategies. The purpose of the study is to identify strategies to further reduce Citizens exposure and enhance the availability of private market residential property insurance. Using claims and policy-level data from 2009 to 2020, the report identifies key trends in Citizens market share and evaluates the effectiveness of various strategies aimed at reducing its exposure.

The analysis highlights that Citizens premiums have remained competitive with private insurers since 2009, occasionally falling below the average rates of Florida focused domestic insurers. The premium per \$1,000 value insured is competitive in some counties but generally higher in others due to the higher risk associated with Citizens concentration in high risk counties. The report's findings further reveal that while Citizens has made efforts to reduce its policy count, external market pressures—such as insurer insolvencies, rising reinsurance costs, and increased hurricane activity—continue to drive growth in its portfolio. The report concludes with policy recommendations, such as promoting loss control measures and encouraging private insurers to assume more risk through depopulation programs.

Dennis et al. (2024) further investigate the interaction between insurance market policy choices, climate change, economic growth and state finances using Florida as a case study. The paper explores the trade-offs between providing affordable insurance and managing the growing contingent liabilities on state finances. The authors employ a Monte Carlo simulation framework to model different policy scenarios over a 30-year horizon, considering both acute and chronic damages. The key focus is on different policy choices—such as raising insurance prices to reduce liabilities or keeping prices affordable to promote growth—impact municipal defaults, state budget deficits, and housing markets.

The findings show that policies aimed at prioritizing affordability led to higher state liabilities but promote growth and reduce the frequency of budget deficit. Whereas policies aimed at minimizing liabilities through higher insurance prices result in more frequent municipal defaults and persistent budget deficits. The study also highlights how income influences insurance demand and affordability, with low-income households facing higher risk of being priced out of insurance market, especially in high-risk areas.

Affordability is a recurring theme in the literature on Florida's insurance market. Eastman et al. (2024) provide empirical evidence on the impact of rising insurance premiums on housing affordability. The study uses QUASR data from 2011 to 2020, which includes information on premiums, policies, insured values, policy cancellations, and non-renewals, segmented by county and quarter. Housing price data is sourced from property tax assessment records, covering 3.8 million property transactions over the same period. These records include detailed property characteristics and sale prices, which are used to construct a county-quarter-level housing price index (NAL-HPI) verified against the Federal Housing Finance Agency (FHFA) HPI.

The authors employ a hedonic pricing model using OLS regression to estimate the effect of homeowners insurance prices on housing values, controlling for property and location specific characteristics. Additionally, a repeat-sales model is applied to account for time-invariant property attributes by focusing on properties sold at least twice. The study uses a Florida regulation mandating auto insurers to participate in the homeowners insurance market as an instrument (IV variable), to address endogeneity. The results show that a 1 percent increase in homeowners insurance prices reduces housing prices by 0.61–0.68 percent (IV estimates), with a stronger effect on mortgage-financed buyers and owner-occupants. The impact is smaller in higher-income areas, where buyers can more easily absorb rising insurance costs. Disaster-related insurance cancellations significantly reduce housing prices, while higher

insurance prices lower the probability of home sales by 0.3 percentage points, accounting for 18 percent of the average sales probability in Florida.

Ben-Shahar and Logue (2016) take a different approach, exploring the unintended consequences of subsidized insurance programs, focusing on how these programs often disproportionately benefit wealthy homeowners in high-risk regions. Empirical analysis highlights that government insurance subsidies are unequally distributed, with wealthier households in coastal or high-risk areas receiving greater benefits. This pattern is particularly evident in Florida, where Citizens offers lower premiums that undercut private insurers, reducing competition and limiting consumer choice.

The study utilizes policy-level data from Citizens, covering 150 risk territories, including information on actual premiums and hypothetical actuarial premiums. To examine the relationship between subsidies and wealth, the authors use zip-code-level house value data as a proxy for wealth. For robustness, they also use coverage limits as an alternative measure. Regression analysis reveals that a 1 percent increase in house value corresponds to a 0.847 percent increase in wealth when measured by coverage limits, and a 0.571 percent increase when measured by house value. The authors conclude that subsidies within Citizens policies disproportionately benefit wealthier. In other words, individuals living in higher value homes tend to receive larger subsidies, increasing the inequality in the distribution of government support.

Several studies have also explored the demand for catastrophe insurance in high-risk areas. Landry and Jahan-Parvar (2011) explore the determinants of flood insurance demand in coastal zones under the National Flood Insurance Program (NFIP). The study uses data from 6,074 residential parcels across nine coastal counties in the U.S. Southeast to analyze flood insurance demand. Collected by the H.J. Heinz III Center under Federal Emergency Management

Agency's (FEMA) direction, the data include parcel characteristics from onsite visits, Geographic Information System (GIS)-based flood zone proximity, county tax records, FEMA's NFIP policies-in-force database, and a 1998 mail survey on demographics and flood risk perceptions. Key variables include marginal premiums, flood zone classification, elevation, erosion rates, and community mitigation projects like beach replenishment. Imputed property values from hedonic regression serve as proxies for asset values.

The authors find that flood insurance demand is generally price inelastic, although subsidized policyholders exhibit greater price sensitivity and higher coverage levels compared to those paying full actuarial rates. Contrary to expectations, only 12 percent of homeowners in the 100-year flood zone report being required by their lenders to purchase flood insurance. The analysis reveals that demand increases with greater flood and erosion risks, particularly in high-risk V-zones, while the relationship between income and coverage is positive but not monotonic, suggesting potential self-insurance behavior among higher-income households. Additionally, the relationship between hurricane return intervals and demand presents mixed results. While shorter hurricane return intervals—indicating higher hurricane risk—are expected to increase demand, the data shows contradictory patterns in some regions. This inconsistency suggests that other factors, such as optimism bias, reliance on government disaster relief, or a perceived sense of security due to structural mitigation, may distort the expected relationship. Thus, the authors recommend interpreting the hurricane-related findings with caution.

Wang et al. (2017) further explore demand for homeowners insurance for wind and flood damage. Using survey data from 321 homeowners in Eastern North Carolina, the authors create a mixed logit model to analyze how premiums, deductibles, and other factors affect insurance decisions. The results show that demand for wind insurance is relatively inelastic, meaning changes in price do not significantly affect how many people buy it. Homeowners are willing

to pay around \$0.60 extra premiums to reduce their deductible by \$1. Variables like deductibles, living closer to the coast, having higher income, and previous experience with hurricanes increase the demand for wind insurance. The study also found that homeowners who had already installed wind protection measures, such as storm shutters or reinforced roofs, were more likely to purchase wind insurance.

Gourveitch et al. (2023) extends the discussion to the broader consequences of mispricing climate risk. Using property transaction data from Zillow's ZTRAX database and flood hazard maps from the First Street Foundation, the authors estimate that residential properties exposed to flood risk are overvalued by \$121–\$237 billion, with a preferred estimate of \$187 billion at a 3% discount rate. Highly overvalued properties are concentrated along the Gulf, Atlantic, and Pacific coasts, with Florida alone accounting for over \$50 billion. The study shows that low-income households are at the highest risk because they could lose a lot of their home's value if prices drop. Local governments that depend heavily on property taxes could also face budget problems if property values fall. Surprisingly, most of the overvaluation comes from homes that aren't officially marked as being in high-risk flood zones, which makes the issue harder to identify.

Post loss financing mechanisms are another critical topic in literature. Cole et al. (2011) examines the role of state government in catastrophe financing, focusing on post loss financing. The study uses the Florida homeowners insurance market as a case study, given the potential magnitude of post-loss assessments and related subsidies. The study uses county-level data from the FLOIR, including hurricane and non-hurricane premiums for 25 insurers representing over 60 percent of the market. The methodology compares the current post loss assessment structure, which is based on full premiums, to a hypothetical risk-based assessment structure. The analysis estimates subsidies by calculating the difference between what policyholders pay under the current structure and what they would pay under a risk-based structure. The authors

simulate two deficit scenarios: a 1-in-100-year storm and a scenario replicating combined losses from 2004 and 2005 hurricanes.

The results show significant cross-subsidies, where inland counties disproportionately subsidize high-risk coastal counties such as Monroe. Post loss assessments can reach up to 12 percent of median HHI in some counties under a risk-based approach, highlighting equity and fairness concerns in the current financing structure. The study emphasizes the uneven burden of post loss assessments, with inland residents bearing a higher share of the financial impact despite lower hurricane exposure.

Finally, Born and Klimaszewski-Blettner (2013) examine the factors influencing U.S. property insurers willingness to continue offering coverage in catastrophe prone regions. Using National Association of Insurance Commissioners (NAIC) annual statement data and SHELDUS county-level natural hazard data from 1984 to 2007, the study analyzes nearly 500,000 observations, comparing homeowners and commercial insurers. The authors apply a fixed-effects panel logit regression, where the dependent variable is the likelihood of insurers exiting or reducing business in a state by thresholds of 30 percent, 40 percent, 50 percent, or 60 percent. Key independent variables include loss ratios (underwriting performance), catastrophe losses (state-level damages relative to premiums), unexpected frequency of disasters, and regulatory constraints such as strict rate regulation, residual market programs, and cancellation bans.

The study finds that insurers are more likely to exit or reduce business after poor financial performance or severe natural disasters, especially in the heavily regulated homeowners market. Commercial insurers are more resilient due to greater diversification, higher reinsurance, and fewer restrictions. Strict regulations like price controls or mandatory coverage can unintentionally force insurers out, reducing coverage availability. The authors suggest a

balanced approach to regulation to protect consumers while giving insurers the flexibility to manage risks.

Overall, the literature highlights the complex challenges facing Florida's homeowners insurance market, driven by rising climate risks and regulatory trade-offs between affordability and fiscal responsibility. This review underscores the importance of balancing affordability with sustainable financing strategies to mitigate long-term risks, which is crucial for understanding Citizens growing role and its potential implications for Florida's insurance landscape.

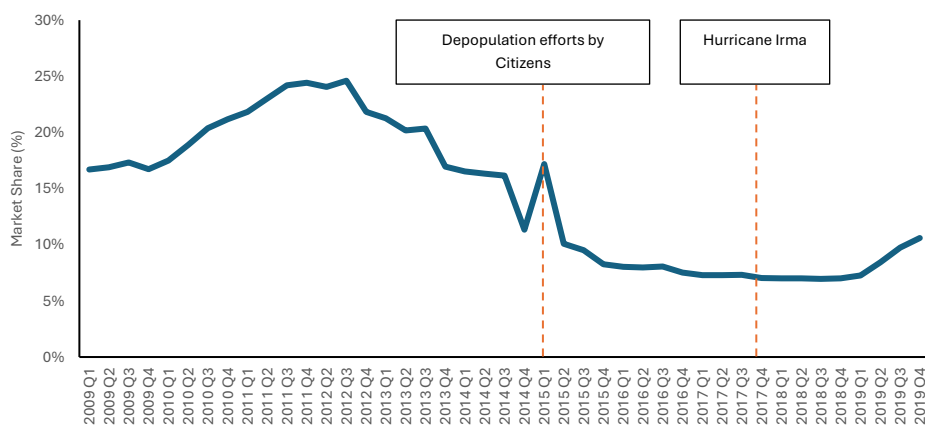
3. Citizens Overview

In 2002, under the leadership of Governor Jeb Bush, the Florida Legislature passed Senate Bill 1418, commonly referred to as the "Windstorm Bill." This legislation was introduced in response to the challenges posed by the devastating impact of Hurricane Andrew a decade earlier, in 1992. The hurricane had led to the collapse of seven Florida property insurers and the withdrawal of all national underwriters from the state. This left homeowners struggling to find windstorm insurance coverage in the private market.

To address this crisis, the Windstorm Bill was introduced to ensure better availability of catastrophic windstorm insurance for Floridians. As part of the bill, the Florida Windstorm Underwriting Association (FWUA) and the Florida Residential Property and Casualty Joint Underwriting Association (JUA) were merged to create Citizens.

Originally established as an insurer of last resort², Citizens commanded a significant market presence with 1.47 million policies or 23 percent of Florida's wind coverage market in 2011 (Figure 2).

Figure 2: Market Share of Citizens Based on Total Personal and Commercial Residential Policies in Florida (2009–2019)



² "Insurer of last resort" in this report refers to insurance firms that provide coverage to those who are entitled to coverage through private market but are unable to do so (Citizens Property Insurance Corporation, 2025a).

Note: Citizens market share peaked at over 25 percent in 2012 before declining sharply after policy reforms and depopulation efforts. By 2017, its share stabilized below 10 percent, with a slight increase toward the end of 2019.
Source: QUASR, FLOIR

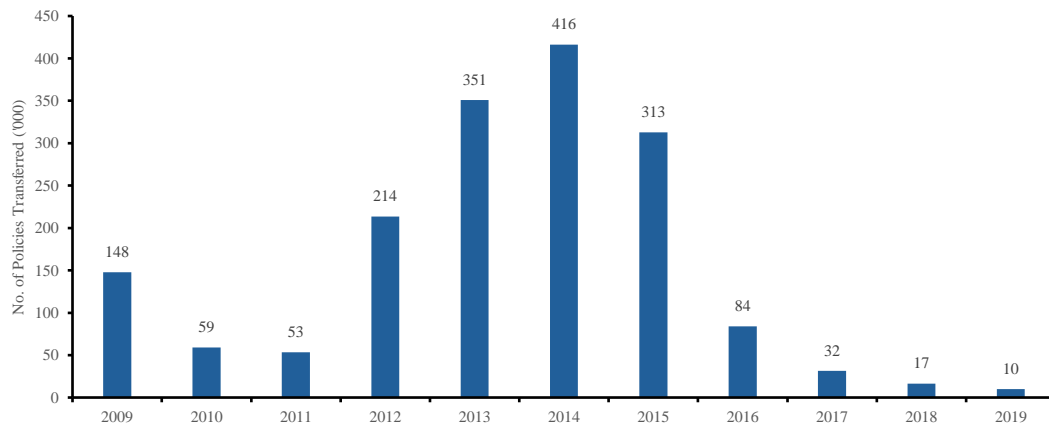
Recognizing the financial risks inherent in its extensive exposure, and consistent with its foundational role, Citizens implemented key exposure reduction initiatives, including introduction of depopulation programs and time restrictions for legal actions. Citizens aimed at reducing exposure in 3 keyways – increased premiums to reduce competitiveness with private market using a glide path, facilitated direct transfer of policies to private insurers, and used reinsurance contracts to offload exposure.

A "glide path" plan was put into place by Citizens in 2010 to lessen competition with private markets and raise premium prices by no more than 10 percent per year to actuarially fair levels. The private market's annual rate hikes have regularly surpassed 10 percent, and citizens have hardly ever asked for rate changes that are comparable to the 10 percent cap, therefore in reality, citizens rates have remained lower than the private market in many places. In 2021, the legislature revised the glidepath to increase by 1 percent annually for 5 years, reaching 16 percent in 2026, where it will remain constant (Florida Senate, 2024).

Another measure taken by Citizens to reduce exposure was the depopulation program, also known as the takeout program. The initiative aimed at transferring policies from Citizens portfolio to private insurers. An extension of the depopulation program was the establishment of the Property Insurance Clearinghouse and the Florida Market Assistance program, which sought to match homeowners and businesses seeking insurance coverage with authorized private insurers. The primary goal of these programs was to systematically move policies away from Citizens and back into the private insurance market. In 2022, to further support the effort of depopulation, lawmakers approved a legislative change requiring Citizens customers to accept offers of coverage from private insurers if the offers are within 20 percent of the cost of Citizens premiums (Team, 2023). For example, when a homeowner receives an offer of

coverage from a private insurer that is 19 percent more than the premium charged by Citizens, the homeowner has to accept it. If the offer was over 20 percent of the Citizens premium, the homeowner does not have to take it.

Figure 3: Number of Policies Transferred from Citizens to Private Insurers in Florida (2009–2019)



Note: The bar chart illustrates the annual number of residential policies transferred from Citizens to private insurers in Florida between 2009 and 2019. Policy transfers peaked in 2014 at 416,000, reflecting the state's depopulation efforts to reduce Citizens' policy count.

Source: QUASR , FLOIR

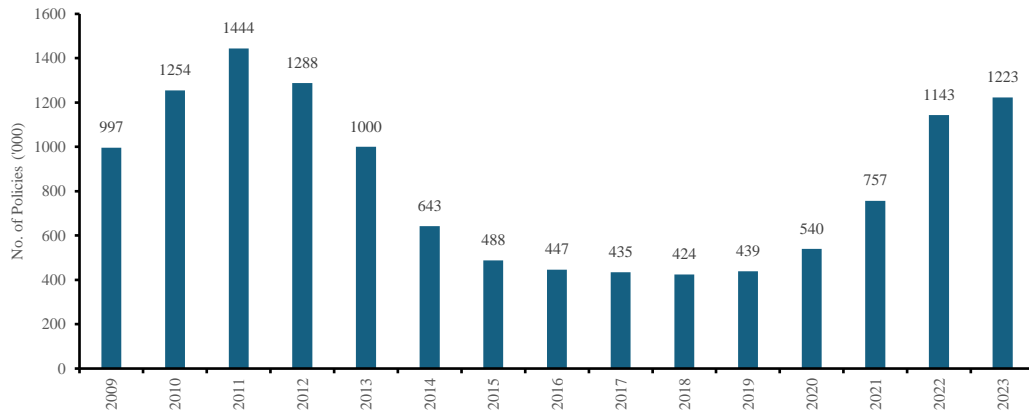
These measures effectively reduced its policy count by 70 percent, lowering its market share to 4 percent by 2019. However, the decline in policy numbers proved to be temporary (Figure 3), as Citizens experienced a substantial increase in policies over the past four years. This surge has largely been attributed to the exit or insolvency of many private insurers from the Florida insurance market, along with their imposition of prohibitively high rates due to a series of damaging hurricanes. These factors compelled numerous policyholders to switch to Citizens. Specifically, Citizens policies grew from 453,411³ in 2020 to 1,123,490⁴ by 2024, marking a 147 percent increase and resulting in a current market share of 17 percent⁵.

³ As on 31 December 2020. (Citizens Property Insurance Corporation, 2020).

⁴ As on 29 February 2024. (Citizens Property Insurance Corporation, 2024).

⁵ As on 30 September 2023. (Citizens Property Insurance Corporation, 2023b).

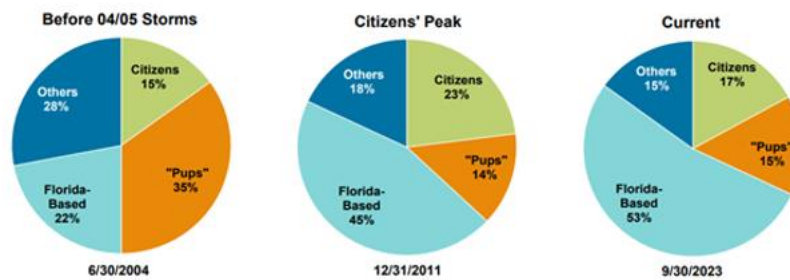
Figure 4: Citizens Homeowners policies in force (as of 12/31 for each year shown)



Note: This figure illustrates the number of homeowners insurance policies held by Citizens from 2009 to 2023, showing a significant increase in recent years, particularly after 2020.

Source: QUASR, FLOIR

Figure 5: Market Share Based on Total Insured Value (2004, 2011, 2023)

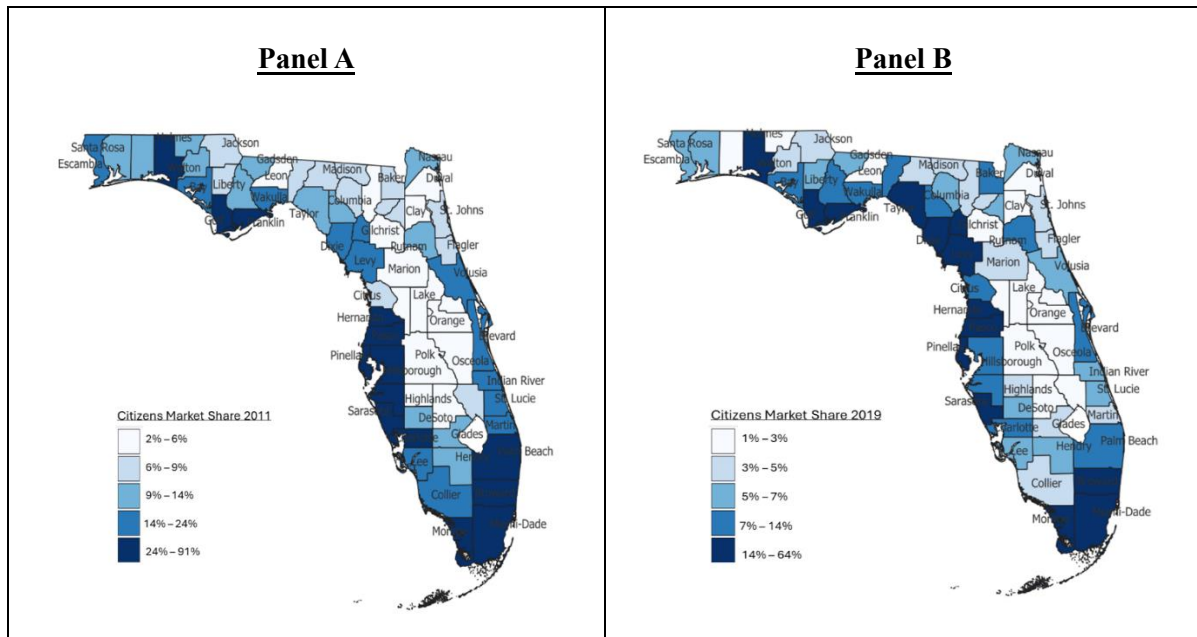


Note: The figure compares the shares before the 2004/2005 storms, during Citizens peak in 2011, and the current distribution in 2023, highlighting changes in the roles of Citizens, Florida-based insurers, "Pups," and others over time.

Source: Citizens Market Share report, September 2023

We further analyze county-level changes in Citizens market share to assess the evolution of its risk distribution across regions. Between 2011 and 2019 (Figure 6), Citizens market share declined from 6 percent – 24 percent to 1 percent – 7 percent in low-risk inland counties and from 24 percent – 91 percent to 14 percent – 64 percent in high-risk coastal counties. The significant reduction in low-risk counties suggests that private insurers captured more policies in these areas, while Citizens retained a higher concentration of policies in high-risk regions due to its role as the insurer of last resort.

Figure 6: County-Level Market Share⁶ of Citizens in Florida (2011 vs 2019)



Note: Panel A: Citizens market share by county in 2011, ranging from 2 percent to 91 percent, with higher concentrations in coastal and high-risk areas.

Panel B: Citizens market share by county in 2019, showing a significant decline, with most counties now below 14 percent, reflecting the effects of depopulation and policy reforms.

Source: QUASR, FLOIR

How Citizens Finance Deficit

Citizens has a unique ability to address post-event deficits by issuing revenue bonds, which are funded through surcharges on future premiums. This approach allows Citizens to spread the financial burden of catastrophic losses over time, reducing the immediate capital needed to cover claims and making insurance more affordable overall (Hartwig et al., 2020).

However, this strategy has its limits. The effectiveness of using future premiums to cover current losses depends on several factors, including the size of Citizens premium base and the interest rates on the bonds. If the number of policyholders decreases or if demand for insurance is highly sensitive to price changes, the ability to generate sufficient revenue through premium surcharges becomes more difficult. Additionally, higher borrowing costs would force

⁶ Based on policies in force.

Citizens to either issue longer-term bonds or impose higher surcharges on policyholders to repay the debt.

A recent report by Fitch highlights the potential challenges Citizens may face in funding future deficits. The report warns that repeated large-scale storms could push Citizens to rely heavily on the bond market, possibly overlapping assessments on policyholders. While the current base of policyholders is growing, this trend could slow if frequent storms hinder rebuilding efforts or if economic conditions weaken. The situation could worsen if more private insurers exit the Florida market, further increasing Citizens policy count and risk exposure. These dynamics underscore the ongoing financial pressures faced by Citizens as it navigates its expanding role in Florida's insurance market (Fitch Ratings, 2022).

When Florida is hit by a hurricane, Citizens is prepared to handle the financial fallout thanks to its resilient financial structure. This resilience stems from a combination of robust reserves and a carefully designed deficit funding system, which together enables Citizens to navigate the challenges of providing coverage in a state highly vulnerable to hurricanes. At the core of its financial resilience are three specialized accounts—Coastal, Personal Lines, and Commercial Lines (Citizens Property Insurance Corporation, 2025b) each tailored to address specific insurance needs while adhering to statutory requirements. Citizens ability to absorb financial shocks are supported by 3 accounts. Coastal Account (CA) offers wind-only and various peril insurance to both residential and commercial policyholders in designated coastal vicinities. Personal Lines Account (PLA) caters to the state-wide provision of residential multi-peril policies and those excluding wind damage. Lastly, Commercial Lines Account (CLA) extends coverage to commercial entities, including condominium associations across Florida, for both residential and non-residential properties. Each account is managed separately, maintaining its own reserves and deficit protocols to ensure transparency and financial accountability.

When the reserves in these accounts are insufficient to cover claims after a major storm, a three-tiered assessment approach to bridge the financial gap. The first step is a policyholder surcharge, where Citizens first imposes a surcharge on its own policyholders, capped at 15 percent of the policy premium per account – a maximum of 45 percent of their premium. This surcharge is applied annually and acts as the initial measure to address deficits occurring in any of the 3 accounts. If the CA still faces a shortfall, a standard assessment of up to 2 percent is levied on property and casualty insurance premiums statewide including those of private – market policy holders, to quickly generate revenue within 30 days. For any remaining deficits, emergency assessments are applied, imposing up to 10 percent annually per account on both Citizens and private-market holders statewide. These assessments, which fund post-event bonds for claim payouts, can continue until the deficit is fully resolved.

Following the 2004 and 2005 hurricane seasons, which brought eight major storms to Florida, Citizens faced a \$1.7 billion shortfall. To address this, Citizens issued a 10-year post-event bond worth \$1.38 billion. To repay the bond, a 1.4 percent emergency assessment was imposed on all property and casualty insurance policyholders in the state starting in 2007. This assessment was later reduced to 1 percent in 2011 and fully removed on June 1, 2015, after the debt was repaid ahead of schedule.

4. Data

Data is obtained from a variety of sources as described below:

Insurer information

We source data on Citizens from QUASR, provided by FLOIR. The QUASR dataset offers quarterly, county-level information on both Citizens and Private insurers, including the number and types of policies, total insured value, and premiums from 2009 to 2019. Private insurers in this report refer to all other⁷ insures reported in the QUASR data.

The analysis has two parts. First, we examine differences in average premiums calculated as premium per policy between Citizens and Private insurers across counties. We analyze how average premiums vary with median income, house values, and recent hurricane activity, using Wind-only HW-2⁸ policy data to focus on hurricane-specific coverage.

A limitation is that from 2016 onward, some insurers⁹ filed data as trade secrets, resulting in incomplete records. To address this, we retain only insurers with complete data from 2009 to 2019 and further filter for firms providing Wind-only HW-2 policies. Additionally, since Citizens does not offer Wind-only HW-2 policies in all counties, we limit the analysis to counties where Citizens provides such coverage. To enable easier comparison, we calculate average premiums for Private insurers by county, year, and quarter, then derive a single weighted average value for these variables using policy counts for direct comparison with Citizens. We acknowledge that the use of policy counts as weights may not fully capture the

⁷ Other insurers in this category include: (i) Citizens; (ii) Florida-only subsidiaries ("pups") of major national insurers; (iii) Florida-based domestic companies; and (iv) non-domestic, nationwide property insurers like USAA.

⁸ This policy is available for detached, single-family homes and duplexes in which at least one unit is owner-occupied. The owner must live in the home as their primary residence. It covers the building, other structures on the property, and the owner's personal property, and also provides additional living expense and personal liability coverage (Citizens Property Insurance Corporation, 2025e)

⁹ State Farm Florida's data has been unavailable since 2014, with three more insurers excluded in 2017 and 22 in 2019. As a result, 2019 data exclude a significant portion of Florida's residential property insurance market.

risk exposure of firms, potentially oversimplifying variations in regional risks. Additionally, filtering for firms with complete data reduced the sample size, which may have introduced selection bias by excluding firms with incomplete records, thereby limiting the representativeness of the findings.

Table 1 presents descriptive statistics for the cleaned Wind-only HW-2 policy data, comparing Citizens and private insurers.

Table 1: Descriptive statistics

Variable	Count	Mean	SD
<i>Citizens</i>			
No. of Policies in Force	957	2412	797
No. of new policies written	957	86	247
No. of policies canceled due to hurricane	957	0	0
Total value of exposure (\$ Bn)	957	\$ 1.14	\$ 2.68
Premium per policy (\$ Bn)	957	\$ 1,986.72	\$ 796.93
Premium per exposure	957	0.004	0.001
<i>Private</i>			
Premium per policy (\$ Bn)	957	\$ 4,937.87	\$ 4174.91
Premium per exposure	957	0.008	0.003

Note: The table compares Citizens and private insurers for Wind-only HW-2 policies. Citizens has more policies in force but lower average premiums per policy and per exposure, while private insurers show higher premium variability.

For the second part of the analysis, we forecast premiums and policies for Citizens over the next 10 years under two scenarios: (1) Citizens retaining its current market share and (2) Citizens assuming a monopoly position. To conduct this analysis, we utilize data on all policies and premiums for the entire market, including both commercial and residential policies in Florida. This data is sourced from Citizens Quarterly Market Share Reports, which provide state-level figures for market policies and premiums written. Additionally, historical data on losses incurred and the loss ratio (loss per direct premium written) is obtained from Citizens Quarterly Business Reports. These datasets cover the period from 2009 to 2024.

One key advantage of using state-level data is the inclusion of comprehensive figures, even for firms that report their data under trade secret policies, ensuring that the analysis

incorporates the full scope of Florida’s insurance market up to 2024. However, a notable limitation of this approach is the lack of granular information on premium distribution by Citizens individual accounts, such as the CA or PLA and by county. As a result, the analysis is conducted at an aggregate level, rather than distinguishing between accounts and counties. While this provides a broad overview of Citizens financial position and trends, it limits the ability to assess account-specific risk exposures and premium dynamics.

Income Data

Median HHI data is sourced from the U.S. Census Bureau, specifically the American Community Survey (ACS) Subject Table S1903. This dataset provides annual county-level estimates from 2009 to 2019. For compatibility with quarterly datasets, we assume that the median HHI remains constant within each year, applying the annual value uniformly across all quarters. Table 2 below gives an overview of the average median HHI in Florida (2009-2019).

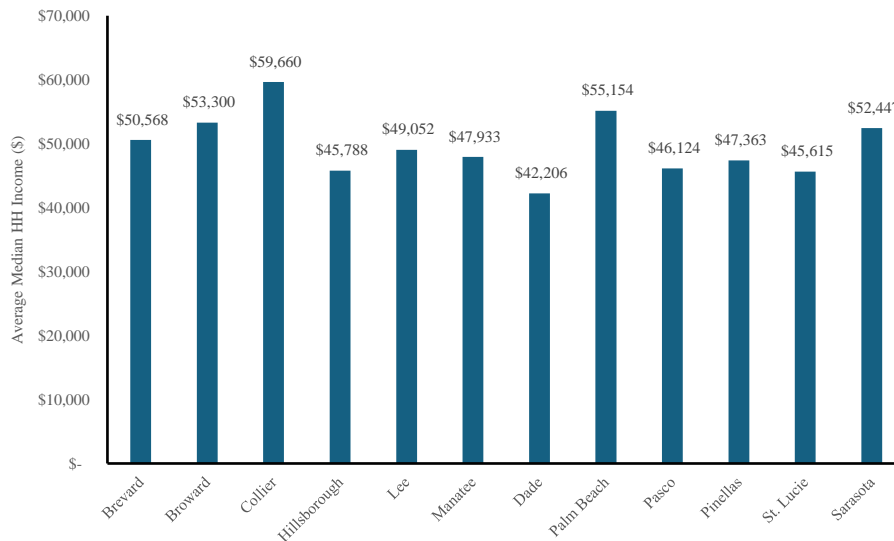
Table 2: Average Median HHI in Florida (2010-19)

Year	Count	Mean	SD
2019	67	\$ 51,290	\$ 10,300
2018	67	\$ 49,046	\$ 9,807
2017	67	\$ 47,144	\$ 9,126
2016	67	\$ 45,205	\$ 8,382
2015	67	\$ 44,046	\$ 7,665
2014	67	\$ 43,908	\$ 7,506
2013	67	\$ 43,716	\$ 7,389
2012	67	\$ 43,876	\$ 7,428
2011	67	\$ 44,627	\$ 7,424
2010	67	\$ 44,269	\$ 7,476
2009	67	\$ 44,269	\$ 7,476

Source: ACS Survey Data

Figure 3 highlights the average median HHI for very high-risk counties in Central and South Florida. Collier County has the highest average income at \$59,660, while Miami-Dade County reports the lowest at \$42,206. Other counties, such as Palm Beach, Broward, Leon, and Bay, fall within this range.

Figure 7: Average Median Household Income for Very High-Risk¹⁰ Florida Counties (2009-2019)



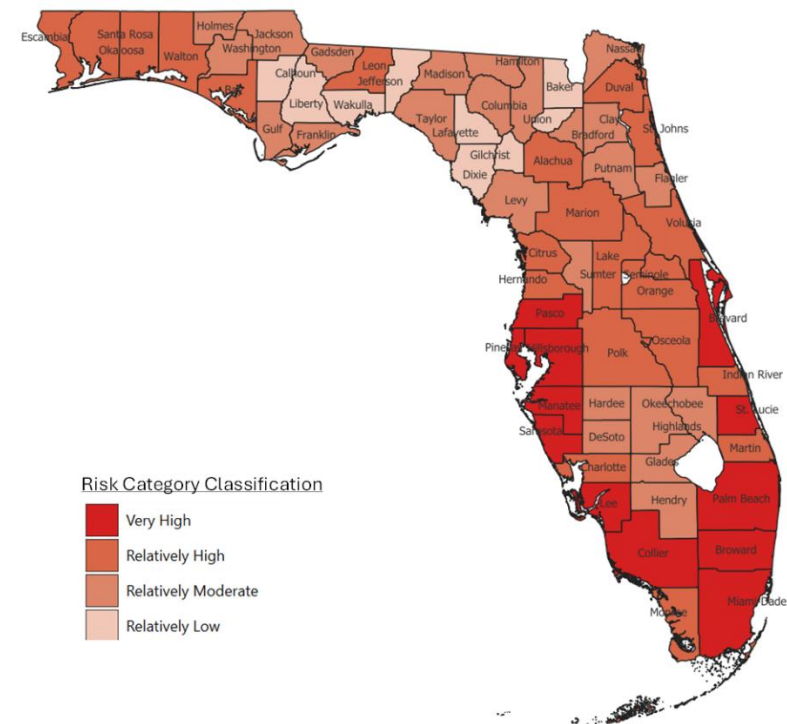
Source: ACS Survey Data

Risk Data

Risk data is sourced from FEMA's National Risk Index (NRI). This static, county-level dataset includes key variables relevant to hurricane risk. These variables include Hurricane annualized frequency which represents the average number of recorded hurricane events per year, calculated over a record period of 169.9 years for the Atlantic Basin and 69.04 years for the Pacific Basin. Hurricane exposure (building value and total exposure), which measures the value (in dollars) of buildings, population (both people and population equivalence), and agriculture that are exposed to hurricanes within a community. Hurricane risk index score, which represents a community's relative risk for hurricanes compared to other U.S. regions, with scores above 95 classified as high risk.

¹⁰ Risk rating classification based on FEMA National Risk Index (NRI).

Figure 8: Florida Counties Risk Classification

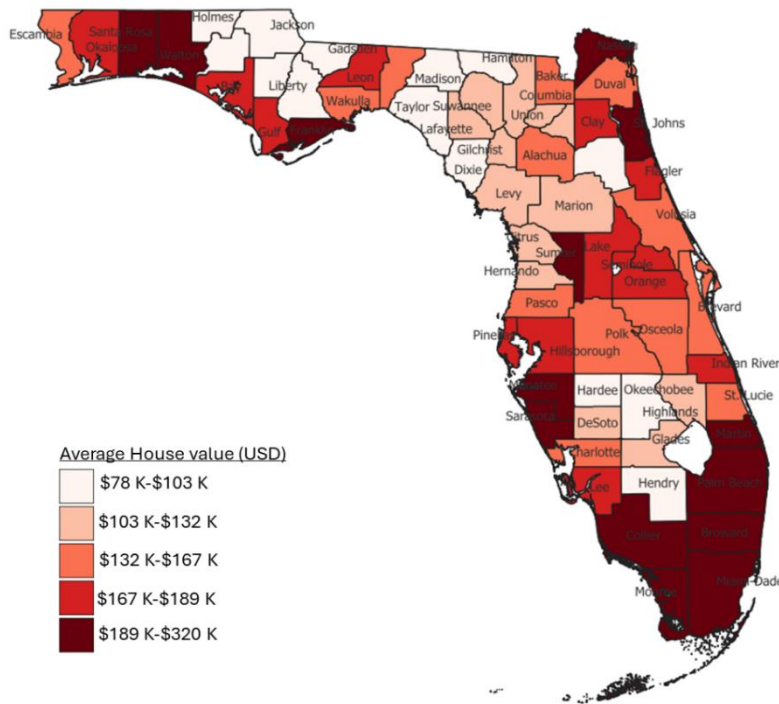


Note: Map displays hurricane risk scores (80–95) across Florida counties. Darker red indicates very high risk (score greater than 95), concentrated in southern and coastal areas, while lighter shades represent lower risk.
Source: FEMA's National Risk Index

House Value Data

To estimate the average home value the Zillow Home Value Index (ZHVI) data is used, which reflects the average home value for homes in the 35th to 65th percentile range. County level monthly data from 2009 to 2019 was adjusted quarterly for our analysis.

Figure 9: Florida Counties Risk

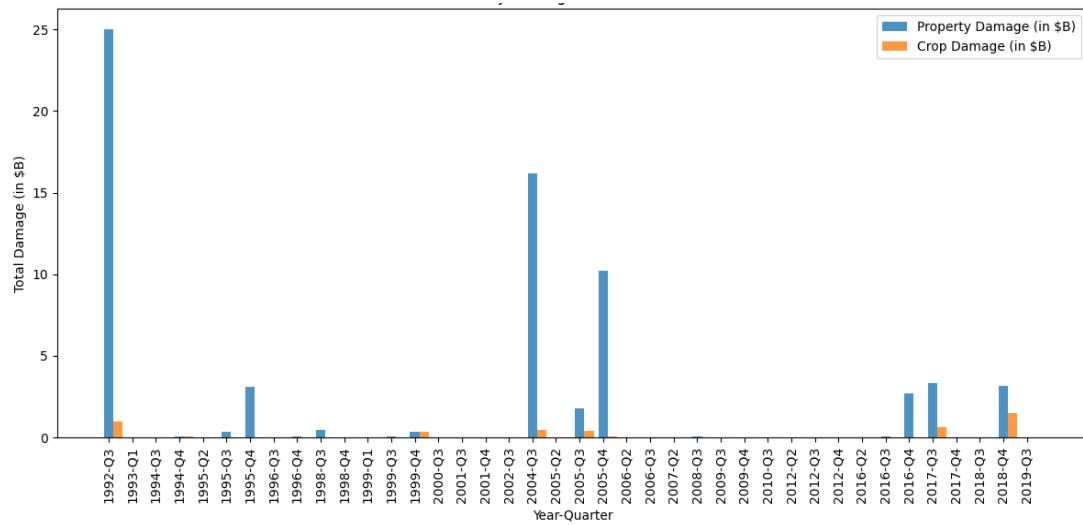


Note: Map illustrates the distribution of average house values across Florida counties, highlighting regional disparities in property market trends, with values ranging from \$78,000 to \$320,000. The highest values, ranging from \$189,000 to \$320,000, are concentrated in South Florida, particularly in Miami-Dade, Broward, and Palm Beach counties
Source: ZHVI, Zillow

Past Hurricane Loss Data

We use data from SHELDUS, a county-level hazard dataset for the U.S., covering natural disasters like hurricanes, floods, and wildfires, along with associated perils such as flash floods and heavy rainfall. From this dataset, we extract information on hurricanes that impacted Florida between 1991 and 2019, including property and crop damage, to map historic hurricane paths by county, year, and quarter.

Figure 10: Quarterly Damages from Hurricanes in Florida (1991–2019)



Note: The graph shows the quarterly amount of damages caused by hurricanes in Florida (Property and Crop Damages in billions of USD) from 1991 to 2019. The biggest damages were in 1992 (Hurricane Andrew) and 2005 (Hurricane Wilma), which showed that property damage from major storms far outweighs any crop damage. The same happens in 2017 (Hurricane Irma) and 2018 (Hurricane Michael), where they also suffered extensive devastation.

Source: SHELUDS

5. Methodology

Premium Determinants and Risk Distribution: The Role of Wealth and Hurricanes

The first part of our thesis examines how premiums charged by Citizens differ from those charged by private insurers, focusing on whether Citizens engage in cross-subsidization. We hypothesize that Citizens subsidize higher-risk properties by charging lower average premiums compared to lower-risk properties. This aligns with Ben-Shahar and Logue's (2016) argument that Citizens premiums do not reflect actuarial risk but instead create an ex-ante cross-subsidy scheme. Conversely, we hypothesize that private insurers, who are expected to use actuarially fair pricing, do not engage in cross-subsidization, as their premiums align more closely with risk data.

To analyze these differences, we use Citizens Wind-Only HW-2 policy, house value, and median HHI data to estimate two regression models.

$$\text{LogPremiumCharged}_{c,y}$$

$$\begin{aligned} &= \alpha + \beta_1 \text{Private Insurer}_{c,y} + \beta_2 \text{LogHouseValue}_{c,y} \\ &+ \beta_3 \text{LogHouseValue}_{c,y} * \text{Private Insurer}_{c,y} + \delta_c + \gamma_y + \epsilon_{c,y} \end{aligned}$$

$$\text{LogPremiumCharged}_{c,y}$$

$$\begin{aligned} &= \alpha + \beta_1 \text{Private Insurer}_{c,y} + \beta_2 \text{LogMedianHHI}_{c,y} \\ &+ \beta_3 \text{LogMedianHHI}_{c,y} * \text{Private Insurer}_{c,y} + \delta_c + \gamma_y + \epsilon_{c,y} \end{aligned}$$

The first model examines the relationship between house value and premiums charged. Specifically, it estimates how a percentage increase in house value (a proxy for risk and wealth) correlates with a percentage change in premiums charged. The coefficient β_2 represents this

relationship: if β_2 is negative, it indicates a negative correlation between house value and premiums charged, suggesting cross-subsidization by Citizens. Interaction terms between house value and insurer type are included to understand how the relationship between premiums charged and house value differs between Citizens and private insurers. For instance, a 1 percent increase in house value for a private insurer is associated with an additional β_3 percent increase(decrease) in premiums charged compared to Citizens.

The second model runs the same analysis with a different independent variable, median HHI, to test the impact of wealth and examine whether the trends observed for house value are consistent with those for median HHI. This allows us to assess whether Citizens provide lower premiums to wealthier households. While we acknowledge that county-level proxies, such as house value and median HHI, may blend less affluent households into categories classified as wealthy, these proxies enable us to identify average trends in premiums charged.

Both models include county fixed effects to control for unobserved, county-specific factors that influence premiums but are difficult to measure directly. These fixed effects isolate the relationship between wealth, risk, and premiums charged while controlling for other factors that vary across counties.

Next, we also examine how premiums charged by Citizens and private insurers respond to hurricane events. To do this, we create a dummy variable (*LaggedHurricane*) equal to 1 if a hurricane occurred in the previous four quarters and 0 otherwise. We assume insurers adjust their premiums during the policy renewal period, making one year a reasonable timeframe to observe hurricane impacts.

We hypothesize that premiums charged increase after a hurricane as insurers attempt to recover losses incurred during the hurricane season. Additionally, we expect the increase to be

greater for private insurers than for Citizens, as Citizens is a state-backed insurer of last resort with glide caps limiting its ability to charge actuarially fair prices.

Using Citizens Wind-Only policy data and the lagged hurricane dummy variable, we estimate the following regression model:

$$\begin{aligned} \text{LogPremiumCharged}_{c,y} &= \alpha + \beta_1 \text{Private Insurer}_{c,y} + \beta_2 \text{LaggedHurricane}_{c,y} \\ &+ \beta_3 \text{LaggedHurricane}_{c,y} * \text{Private Insurer}_{c,y} + \delta_c + \gamma_y + \epsilon_{c,y} \end{aligned}$$

In the above model β_2 captures the average percent change in premiums post-hurricane for Citizens and β_3 captures the additional percent change in premiums post-hurricane for private insurers compared to Citizens.

Impact of Citizens-Only Insurance Market

The second part of our analysis evaluates the implications of Citizens becoming the sole residential insurer in Florida, focusing on affordability and financial stability. Using aggregated data from 2009 to 2024 on policies in force, total insured value, direct premiums written, and historic losses, we forecast premiums and policies for the next 10 years.

As a state-backed, non-profit insurer, Citizens is designed to provide coverage for those unable to find it in the private market. We assume that even as the sole insurer, Citizens would continue to prioritize affordable insurance rather than maximizing profits. Thus, for premium forecasting we create two scenarios.

In the first scenario, we apply ARIMA time-series forecasting, which has been shown to effectively predict insurance premiums based on historical data. According to Namaweje and Geoffrey (2020), ARIMA models are well-suited for premium forecasting because they capture trends, seasonality, and irregularity in time-series data, providing robust long-term

predictions. By identifying optimal model parameters (p , d , q) and minimizing error metrics such as Mean Absolute Percentage Error (MAPE), ARIMA offers an accurate basis for forecasting. Ludkovski et al. (2020), in their study "Trend Analysis for Quarterly Insurance Time Series," also demonstrated that time-series analysis, specifically using the ARIMA model, provides more reliable predictions by effectively capturing seasonality and trends, outperforming linear regression.

Figure 11: Log-Transformed Citizens Premiums and Forecasts Using ARIMA (0,2,1) Model

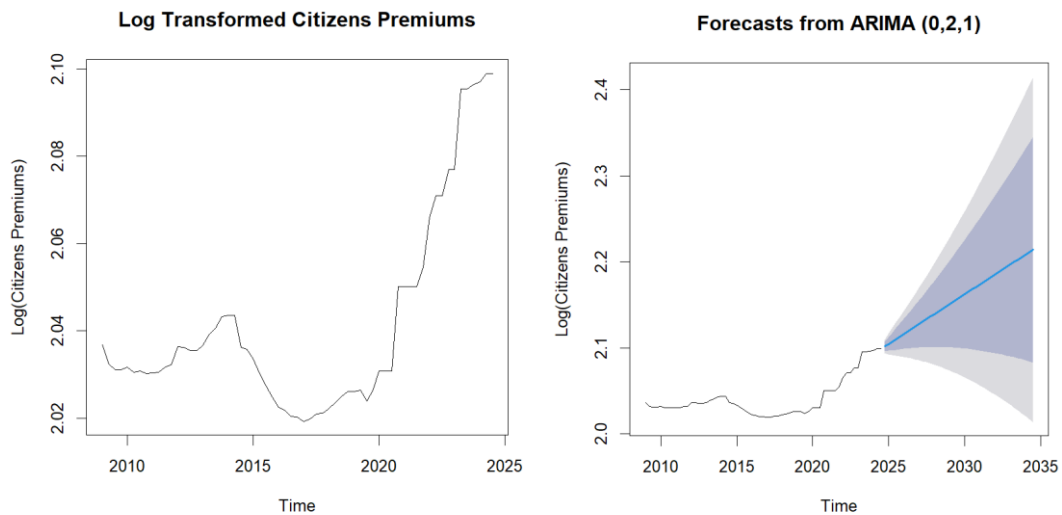
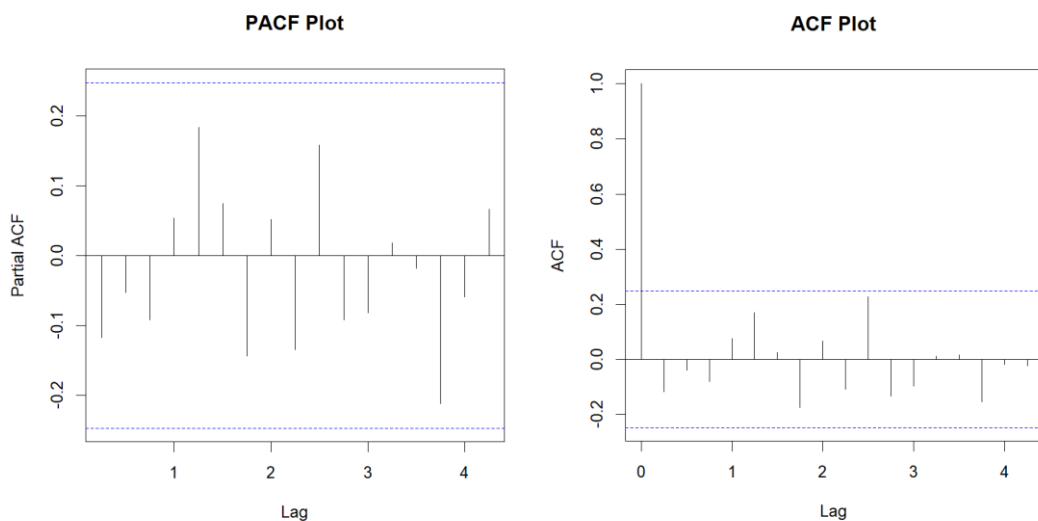


Figure 12: Partial Autocorrelation Function (PACF) and Autocorrelation Function (ACF) Plots for Log-Transformed Citizens Premiums



The ARIMA model was selected using the `auto.arima` function in R, which identifies the best-fitting model by minimizing the Akaike Information Criterion (AIC). The chosen ARIMA(0,2,1) model effectively captures trends in the log-transformed Citizens premiums (Figure 11). ACF and PACF plots (Figure 12) were used to check for autocorrelation in the residuals, ensuring the results are unbiased¹¹. Under this scenario, we hypothesize that Citizens premiums would remain affordable and unlikely to create concerns among Florida homeowners. However, financial stability could become a significant issue, as lower premiums would reduce total revenue, leaving Citizens with limited resources to cover losses in the event of a hurricane. This shortfall could result in a heavier tax burden on Floridians to offset the financial gap.

In the second scenario, we use the glide path, a statutory framework capping Citizens annual premium increases (e.g., 13 percent in 2024, 14 percent in 2025, and 15 percent from 2026 onward). While Citizens has historically kept its rates below these caps, this scenario assumes strict adherence to the glide path, providing a conservative upper-bound estimate for premium increases. This is implemented using the following formula:

$$Premium_{t+1} = Premium_t \times (1 + \text{Glide Path Cap})$$

where the premium for the following year is calculated by applying the glide path cap to the current year's premium. Since the increase in the glide path cap was introduced to reduce competition between Citizens and private insurers and to narrow the gap between premiums charged and actuarially fair prices, we hypothesize that premiums under this scenario would become unaffordable, placing significant financial strain on homeowners.

Following the premium forecasting, we proceed to forecast the number of policies under two scenarios: (1) Citizens becomes the sole insurer, and (2) Citizens maintains its

¹¹ See appendix table 7 for results of Ljung box test.

current market share alongside private insurers. Drawing from the study by Pires et al. (2022), we recognize that time-series forecasting models, such as SARIMA, are effective at capturing seasonality, trends, and irregularities in insurance demand. However, an analysis of policy data from 2009 to 2024 revealed no evidence of seasonality in our dataset. Consequently, we adopt the ARIMA model, which is well-suited for forecasting in the absence of seasonal patterns. Refer to appendix¹² for ACF, PACF and Ljung box test results for policy forecasts to ensure that model is unbiased.

We assume that demand for insurance is inelastic, meaning that individuals strongly prefer to remain insured rather than becoming uninsured. Therefore, in a sole-insurer scenario, policyholders previously insured by private insurers are assumed to shift to Citizens, maintaining their insured status. This assumption implies that in such a scenario, Citizens would take on the entire portfolio of policies. Conversely, in a co-existence scenario, Citizens is assumed to retain its current 17 percent market share. The assumption of inelastic demand is supported by findings from Landry and Jahan-Parvar (2011), which demonstrate that flood insurance demand is generally price inelastic, with individuals exhibiting a strong preference for maintaining coverage.

Once forecasts for premiums and the number of policies under each scenario are obtained, we proceed to forecast the expected losses. To estimate future losses, we use historical data on loss distribution and calculate the loss per dollar of premium written as a proxy. While this proxy provides a practical basis for forecasting, we acknowledge that it is a simplistic approach and may underestimate the true impact of future risks. This method does not account for the increased risks associated with climate change or potential changes in cost

¹² Table 8, figure 17 and 18.

structures due to heightened exposure, both of which could significantly alter the loss patterns observed historically.

Given that Citizens is a state-backed insurer, we assume it will maintain cost structures similar to those historically observed. Using the estimated loss per dollar of premium written, we forecast future losses based on the projected premium written (calculated as the product of forecasted premiums and the number of policies in force). We then calculate the annual deficit or shortfall, defined as the difference between the total direct premium written and the total loss incurred. Finally, we assess the implications of these deficits, particularly whether Citizens would need to impose additional taxes or assessments to cover the losses.

6. Results

Premium Determinants and Risk Distribution: The Role of Wealth and Hurricanes

Table 3 presents parameter estimates from OLS regression models with county and year fixed effects. These models analyze how variations in insurer type and household wealth impact the average premium for HW-2 policies. Wealth is measured using two indicators: house value in the first model and median HHI in the second model.

The results from the first model indicate that private insurers charge, on average, 2.12 percent higher premiums per policy compared to Citizens. Additionally, a 1 percent increase in house value is associated with a 0.85 percent decrease in premiums charged by Citizens. This finding suggests that Citizens charge lower premiums for wealthier households or for high-risk, high-loss properties, demonstrating a pattern of cross-subsidization. We further examine whether private insurers follow a similar approach. The results show that for every 1 percent increase in house value, the average premiums charged by private insurers decrease by 0.96 percent. This suggests that private insurers engage in cross-subsidization to an even greater extent than Citizens.

In the second model, where wealth is measured by median HHI, private insurers charge, on average, 3.23 percent higher premiums than Citizens. For Citizens, a 1 percent increase in median HHI results in a 0.77 percent decrease in average premiums, while private insurers show an additional decline of 0.23 percent. These results reaffirm the strong correlation between household wealth and average premiums: wealthier households or properties associated with higher loss potential are charged lower premiums. Moreover, private insurers appear to practice a higher degree of cross-subsidization compared to Citizens.

Both models achieve a good fit, with an adjusted R-squared of 0.82, indicating that 82 percent of the variation in premiums is explained. The residual standard error of 0.28 highlights the precision of the estimates.

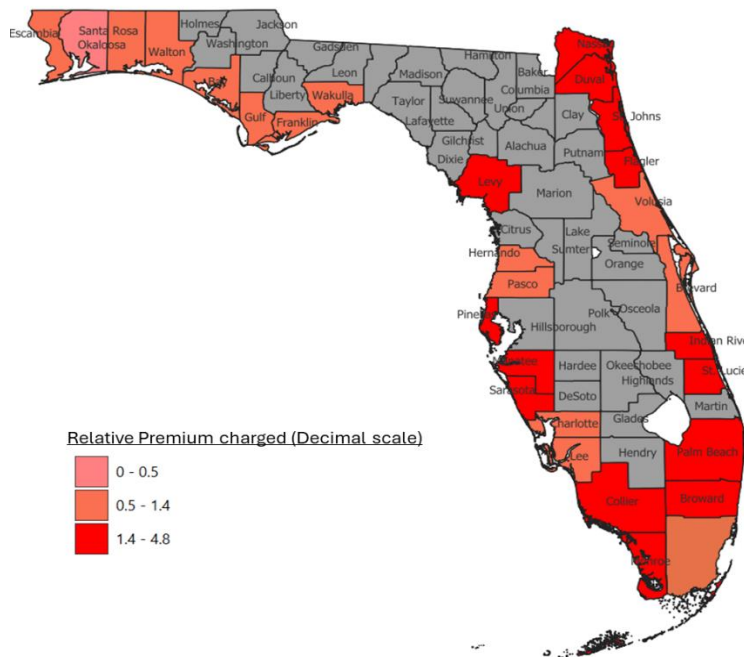
Table 3: OLS Regression Model Results

Variable	House Value		Median Income	
	Coefficient	Std. Error	Coefficient	Std. Error
Private Insurer	2.12***	0.46	3.23***	0.88
House Value	-0.85***	0.11		
Median Income			-0.72***	0.17
Log (House Value) × Private Insurer	-0.11**	0.04		
Log (Median Income) × Private Insurer			-0.23**	0.08
Constant	17.23***	1.28	14.94***	1.86
County Fixed Effects		Yes		
Residual Standard Error	0.28		0.28	
Multiple R-squared	0.82		0.82	
Adjusted R-square	0.82		0.81	
N	1853		1853	

***Statistically significant for 1 percent probability of Type I error; **Statistically significant for 5 percent probability of Type I error; *Statistically significant for 10 percent probability of Type I error.

Note: The table shows OLS regression results with county and year fixed effects, examining how insurer type, property value, and median income impact insurance premiums.

Furthermore, we use spatial analysis to assess geographic variation in the relative premiums charged by commercial insurers in comparison to Citizens (Figure 13). Monroe, Broward, and Collier are among the high-risk coastal counties with the highest premiums; private rates can be up to 4.8 times more than Citizens. These observations align with our regression results, indicating that premiums charged by private insurers are significantly higher and especially in high-risk regions.

Figure 13: Relative Premiums Charged by Private Insurers in Florida

Note: The map above illustrates the relative premium charged by private insurers as a proportion of premiums charged by Citizens in Florida for wind-only policies. The areas highlighted in grey are the counties where Citizens do not provide any wind-only policies. Citizens provides wind-only policies in only 29 counties. The map highlights that Private insurers charge significantly more than Citizens making affordability a major concern for homeowners when looking at private insurance.

We further examine the impact of past hurricanes on the average premiums charged by Citizens and private insurers. The results are presented in Table 4. Consistent with previous findings, private insurers charge higher average premiums compared to Citizens.

When a hurricane occurs, Citizens increase their average premium by 0.13 percent, as hypothesized. However, for private insurers, the results reveal a counterintuitive pattern: average premiums decrease by 0.23 percent four quarters after a hurricane.

Table 4: OLS Regression Model Results – Hurricane Impact

Variable	Coefficient	Std. Error
Private Insurer	0.81***	0.01
Lagged Hurricane Impact	0.13**	0.04
Lagged Hurricane (Private Insurer)	- 0.36***	0.05
Intercept	11.1414***	0.04

County Fixed Effects	Yes
Residual Standard Error	0.28
Multiple R-squared	0.82
Adjusted R-square	0.82
N	1853

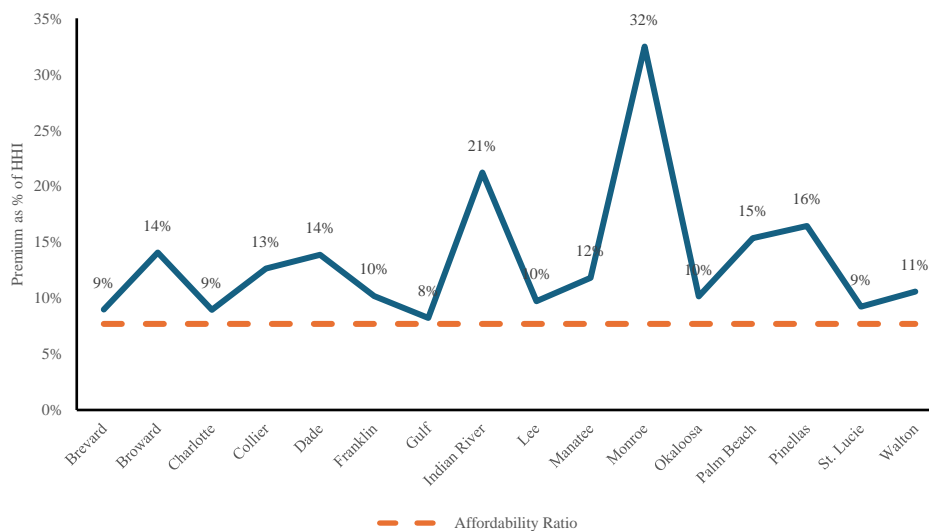
***Statistically significant for 1 percent probability of Type I error; **Statistically significant for 5 percent probability of Type I error; *Statistically significant for 10 percent probability of Type I error.

Note: The table shows OLS regression results with county and year fixed effects, examining how hurricane occurrences impact insurance premiums.

Impact of Citizens-Only Insurance Market

Figure 14 shows premiums as a percentage of HHI across selected counties in Florida. The figure has an affordability threshold set at 8¹³ percent of HHI. Some counties like Monroe (32%) and Indian River (21%) have premiums significantly exceeding the affordability threshold. These trends reinforce concerns about affordability by private insurers in high risk areas.

Figure 14: Counties with Unaffordable Private Insurance Premiums

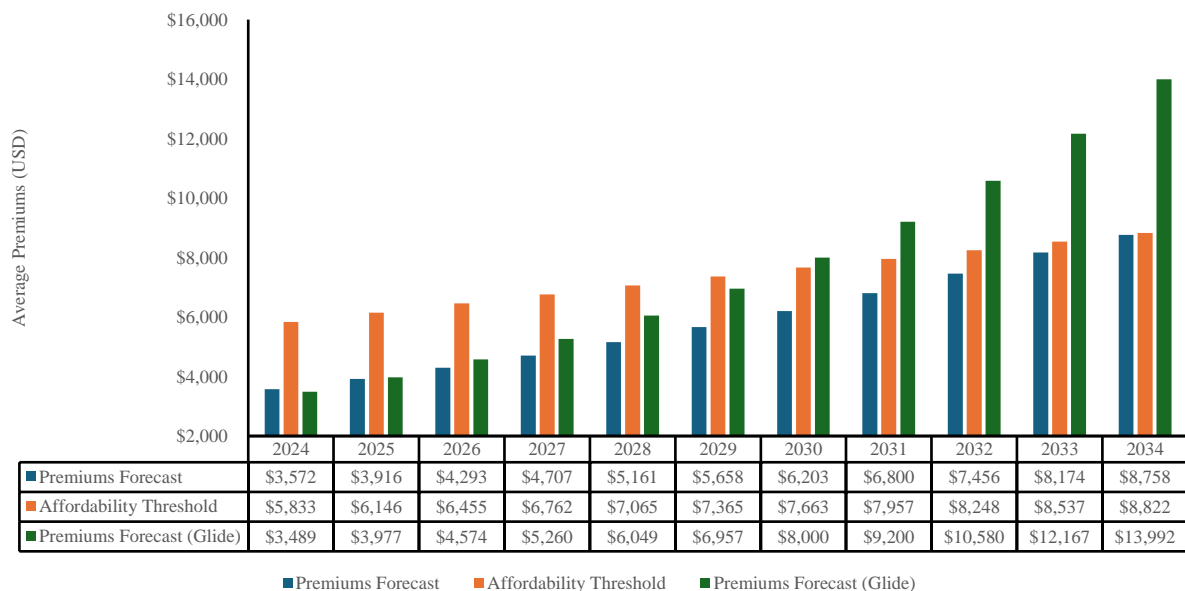


Note: This graph highlights counties where premiums by private insurers, measured as a percentage of median HHI, exceed the affordability threshold of 8%. Counties like Monroe (33%) and Indian River (21%) significantly surpass the threshold, underscoring insurance unaffordability in high-risk regions.

¹³ Affordability thresholds are defined as four weeks of gross household income, or approximately 8 percent of median household income (Paddam, Liu, & Philip, 2023).

If Citizens becomes the sole insurer, it is assumed that, as a state-backed, non-profit government entity, it will continue to prioritize affordable insurance for Florida property owners. Based on this assumption, we consider two scenarios to forecast premiums. In the first scenario, Citizens follows its historical trend, and an ARIMA model is used to project premiums for the next 10 years (2024–2034). In the second scenario, Citizens adopts its predefined glide path, which outlines annual rate adjustments. Although the glide path has been in place since 2010, Citizens has historically implemented rate changes below the glide path, opting for more moderate increases. The results of these forecasts, presented in Figure 15, indicate that under Scenario 1, premiums steadily rise over time but remain below the affordability threshold by the end of the forecast period. In contrast, under the glide path scenario, premiums exceed the affordability threshold by 2026 and are approximately 59 percent higher than the threshold by 2034. This highlights significant affordability concerns for Florida homeowners under the glide path approach.

Figure 15: Projected Premium Trends and Affordability Threshold (2024-2034)



Note: This figure illustrates the forecasted average premiums charged by Citizens under two scenarios—baseline forecast ("Premiums Forecast") and a forecast using glide path specified by Citizens ("Premiums Forecast (Glide)")—from 2024 to 2034. It compares these premiums against the affordability threshold, defined as 8% of median household income. The trends highlight the growing divergence between premium forecasts and the affordability benchmark over time, emphasizing potential affordability challenges for policyholders specially under the glide path scenario.

Source: QUASR, Citizens markets share and business overview reports.

Next, based on our methodology and assumptions, we employ ARIMA models to forecast the total number of policies in Florida, as well as those specifically held by Citizens, for the period 2024–2034. Additionally, we utilize historical loss distribution ratios of Citizens to project future trends. Using these estimates, we calculate the expected loss values for Citizens under two scenarios: (1) maintaining its current market share of 17 percent, and (2) operating as a monopoly.

In the first scenario, where Citizens retains its 17 percent market share, the loss distribution exhibits a pronounced left skew, with the density concentrated around smaller losses. The distribution's tail tapers off rapidly, suggesting that extreme losses exceeding \$20 billion are rare, indicating a relatively stable risk profile for Citizens.

Conversely, in the second scenario, where Citizens becomes the sole insurer in Florida, the loss distribution displays a fat right tail. This extended tail highlights a significantly increased likelihood of extreme loss events due to the expanded risk exposure. The heavier tail underscores the heightened vulnerability associated with Citizens assuming a monopoly position in the insurance market.

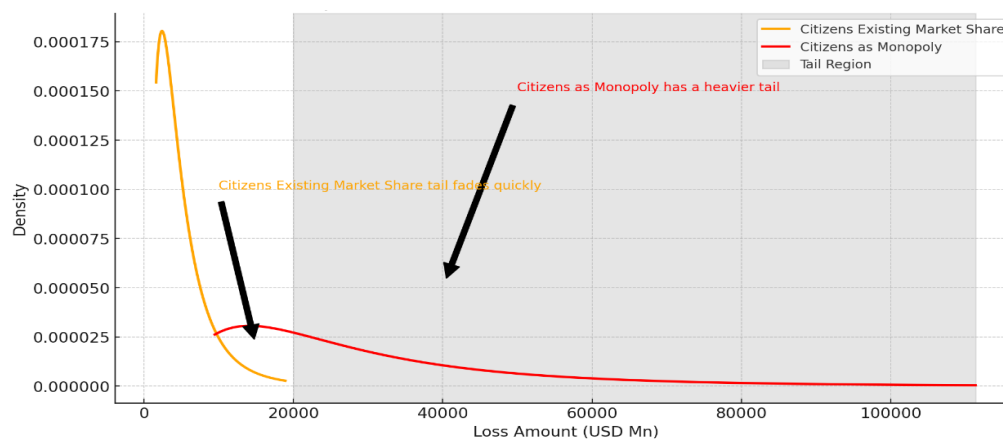
It is important to acknowledge certain limitations in our analysis. Firstly, our forecasts rely on historical data and assume that past trends will persist into the future. This approach likely understates the potential impact of climate change, which could exacerbate loss events and make our projections conservative compared to what might actually occur. While these results provide a useful starting point, further refinement incorporating detailed climate modeling would enhance their accuracy.

Secondly, we assume that Citizens cost structure does not remain constant but instead follows the historical patterns observed. Specifically, we assume that the loss incurred per premium written aligns with past trends, even as Citizens exposure increases significantly.

However, this approach may still understate projected losses, as the transfer of higher-risk policies to Citizens in a monopoly scenario could alter the historical loss patterns. Incorporating these potential changes in cost structures would provide a more accurate estimate of future losses.

Further, we extend this analysis to a scenario where Citizens increases its average premiums following the “Glide Path” approach. The results, detailed in the appendix (Figure 19), reveal a similar shift in the loss distribution curves as observed in Figure 16. However, the projected loss values are notably higher in this scenario. Specifically, in the monopoly case, the tail of the distribution extends significantly, with losses exceeding \$50 billion and reaching as high as \$150 billion. This highlights a substantial increase in both the likelihood and magnitude of extreme loss events under the adjusted premium structure.

Figure 16: Comparison of Loss Distributions: Citizens Existing Market Share vs. Monopoly Scenario



Note: The figure compares the probability distribution functions (PDFs) of losses under two scenarios. 1) Citizens existing market share, which is characterized by a quick tail, indicating lower extreme values. 2) Citizens as Monopoly showing a heavier and extended tail, showing a higher probability of extreme loss events. The left fat tail highlights a substantial increase in the risk of extreme losses.

Source: QUASR, Citizens markets share and business overview reports

Table 5 summarizes the financial projections for Citizens Insurance, outlining key metrics such as total premiums earned (total revenue generated), losses incurred (calculated based on loss-to-premium-written ratios), and projected surpluses (net income derived by

subtracting losses from premiums). The table also highlights the projected assessable deficit, which represents losses that exceed Citizens cumulative surplus—a reserve accumulated from prior years' unused revenue. The projections are based on historical data and do not account for potential future climate changes, which could significantly increase losses. Additionally, these estimates exclude the FCFH reimbursements, which would reduce the deficit.

Due to limitations in data availability, such as the breakdown of premiums written and loss distribution across Citizens three accounts (CA, PLA, and CLA), the analysis relies on aggregate values to estimate deficits and the corresponding tax burden on Citizens policyholders. Under a conservative scenario, if a hurricane hits in 2025, Citizens face a deficit of approximately USD 393 million. This results in an estimated surcharge of 7.31 percent on all Citizens policyholders, well below the 15 percent cap, ensuring that no regular or emergency assessments are necessary. By the time a subsequent hurricane occurs, Citizens is projected to build sufficient financial resilience to avoid further assessments. However, it is essential to note that these results are conservative, and the surcharge could increase if actual losses are greater than projected due to the limitations in data and assumptions.

On the other hand, under the scenario where Citizens becomes the sole insurer, the projected deficit increases to approximately USD 2 billion (Table 6). However, as the number of policyholders also rises, the surcharge remains at 7.3 percent, distributed across all Floridians who own insurance policies. This assumes that the demand for insurance is inelastic, meaning individuals prioritize being insured and would transition from private insurers to Citizens rather than remaining uninsured. The increase in the policyholder pool effectively spreads the surcharge across all insured individuals in Florida.

We also test this under the "Glide Path" scenario, the analysis shows that while higher premiums are charged—raising concerns about affordability—Citizens financial resilience

improves due to increased revenue. This creates a balance between affordability and financial sustainability. When premiums exceed the affordability threshold, Citizens is better equipped to manage financial risks and is less reliant on external funding sources in the event of a hurricane. Conversely, lower, more affordable premiums result in higher surcharges and a greater need for external financial assistance to address deficits. This trade-off highlights the tension between maintaining affordable insurance rates and ensuring long-term financial stability.

Table 5: Financial Projections of Citizens with Current Market Share: Premiums, Losses, and Deficits

Year	Total Premium (USD Mn)	Loss Incurred (USD Mn)	Projected Surplus (USD Mn)	Projected Assessable Deficit (USD Mn)
2024	\$ 4,467	\$ 1,609	\$ 2,858	\$ 2,858
2025	\$ 4,897	\$ 1,845	\$ 3,053	\$ 5,911
2026	\$ 5,369	\$ 11,672	-\$ 6,303	-\$ 393
2027	\$ 5,886	\$ 2,378	\$ 3,509	\$ 3,509
2028	\$ 6,454	\$ 2,679	\$ 3,774	\$ 7,283
2029	\$ 7,075	\$ 3,008	\$ 4,068	\$ 11,350
2030	\$ 7,757	\$ 3,365	\$ 4,392	\$ 15,742
2031	\$ 8,504	\$ 18,916	-\$ 10,412	\$ 5,330
2032	\$ 9,324	\$ 4,180	\$ 5,144	\$ 10,474
2033	\$ 10,222	\$ 4,643	\$ 5,579	\$ 16,053
2034	\$ 10,952	\$ 5,033	\$ 5,920	\$ 21,973

Table 6: Financial Projections of Citizens as Monopoly: Premiums, Losses, and Deficits

Year	Total Premium (USD Mn)	Loss Incurred (USD Mn)	Projected Surplus (USD Mn)	Projected Assessable Deficit (USD Mn)
2024	\$ 26,299	\$ 9,473	\$ 16,826	\$ 16,826
2025	\$ 28,833	\$ 10,861	\$ 17,973	\$ 34,799
2026	\$ 31,611	\$ 68,721	-\$ 37,110	-\$ 2,311
2027	\$ 34,657	\$ 13,999	\$ 20,657	\$ 20,657
2028	\$ 37,996	\$ 15,776	\$ 22,220	\$ 42,878
2029	\$ 41,656	\$ 17,708	\$ 23,948	\$ 66,826
2030	\$ 45,670	\$ 19,813	\$ 25,857	\$ 92,683
2031	\$ 50,070	\$ 1,11,371	-\$ 61,301	\$ 31,382
2032	\$ 54,894	\$ 24,608	\$ 30,286	\$ 61,668
2033	\$ 60,183	\$ 27,338	\$ 32,845	\$ 94,514
2034	\$ 64,481	\$ 29,629	\$ 34,852	\$ 1,29,366

7. Conclusion

This thesis examines the formidable challenges facing Florida's homeowners' insurance market through a detailed discussion of the role that Citizens plays in providing affordable coverage in a time of increasing climate risks. An analysis of premium-setting behavior, affordability trends, and financial sustainability, this study offers valuable insight into the rising tensions between affordability and financial sustainability in a state that regularly endures catastrophic weather events.

The first section of the analysis demonstrates substantial premium disparities, with Citizens charging, on average, lower premiums than private insurers — a reflection that Citizens is fulfilling its affordable coverage mandate. These differences are significant in high-risk counties such as Monroe and Indian River, where private premiums can differ by five times the premiums charged by Citizens.

The results show both Citizens and private insurers cross-subsidize across risk classifications, though private insurers show a stronger tendency to reduce premiums for wealthier households or high-risk properties. This study challenges the notion that cross-subsidization is unique to Citizens. Our analysis of hurricane impacts on premiums showed that Citizens modestly increased premiums in the aftermath of hurricanes, a move counterintuitive to the behavior of the private market that reduced premiums following hurricane damages.

The second half of the analysis discussed what it would mean for Citizens if it became the only residential insurer in Florida. Scenarios of forecasting using ARIMA models indicated that Citizens could maintain premiums below the affordability threshold in the short term, but that financial resilience could weaken under a monopoly scenario. Under this scenario, loss projections showed a marked increase in the probability of extreme losses, evidenced by

heavier right tails of the loss distributions. This captures the reality of a far more exposed Citizens as the only coverage source, especially during a significant hurricane. Further, with premium rate increases limited to a statutory "glide path," many policyholders' premium costs would reach unaffordability levels by 2026, which would stretch Florida households even more thinly financially.

The findings also underscore the financial risks posed by Citizens deficit funding mechanisms. Citizens uses surcharges and post-event assessments as a means of addressing shortfalls in the short term, but the increasing magnitude of its exposure makes it difficult to continue this approach for the long run. Should a violent hurricane season happen, Citizens could apply major assessments on policyholders statewide, putting an extra financial burden on households and perhaps requiring increased federal help.

This research highlights the challenging balance between keeping premiums low and maintaining financial viability. Citizens new strategy focuses on being the lowest price option, but that is a financial gamble, and the company has a large share of Florida's insurance market. The implications of this thesis show that a more balanced approach is needed within Florida's insurance market.

Although this thesis presents important contributions, it also has its limitations. Over the course of its analysis, it relies on historical numbers and assumes that trends from the past will continue — which are likely understatements of the impact of climate change. Moreover, aggregate data and simple assumptions like inelasticity of insurance demand may hide the much more nuanced mechanisms of the workings of the insurance market. Future research could overcome these limitations by applying detailed climate projections, household-level data, and dynamic demand models.

The bottom line is that this thesis points out an important service Citizens does by providing affordable coverage to Floridians. But, with Citizens gaining market share, there's a tricky and precarious line to walk between affordability and financial sustainability. These challenges must be met by a collaborative effort between policymakers and other stakeholders, implementing reforms that sustain affordability while ensuring Florida's insurance market remains on a firm footing for the long haul. Only with this type of work can Florida create a resilient insurance system that protects its residents against the worsening risks associated with climate change.

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9. Appendix

Table 7: Residual Diagnostics: Ljung-Box Test for Autocorrelation (Citizens premiums)

Model	Test Statistic	df	p-value
ARIMA (0,2,1)	6.69	7	0.46

Ljung Box test is conducted to test if ARIMA (0,2,1) model exhibits serial correlation. The null hypothesis of the test states the residuals are independently distributed (i.e. no significant autocorrelation). The results suggest of the test suggest that there is no significant autocorrelation as we fail to reject the null hypothesis (p- value greater than 0.05).

Figure 17: Citizens demand Forecasts Using ARIMA (0,1,1) Model

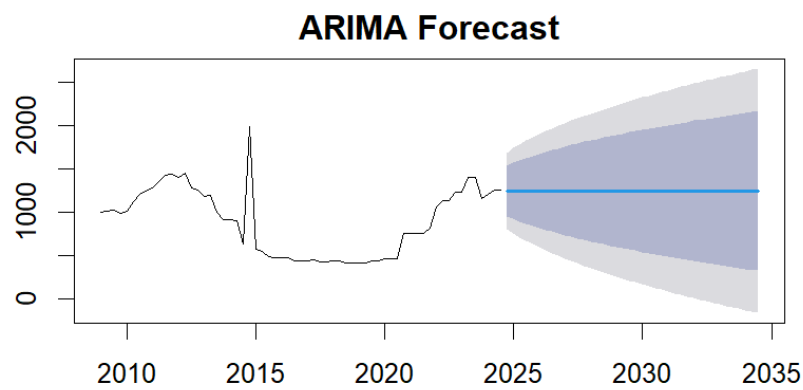


Figure 18: Partial Autocorrelation Function (PACF) and Autocorrelation Function (ACF) Plots for Insurance demand

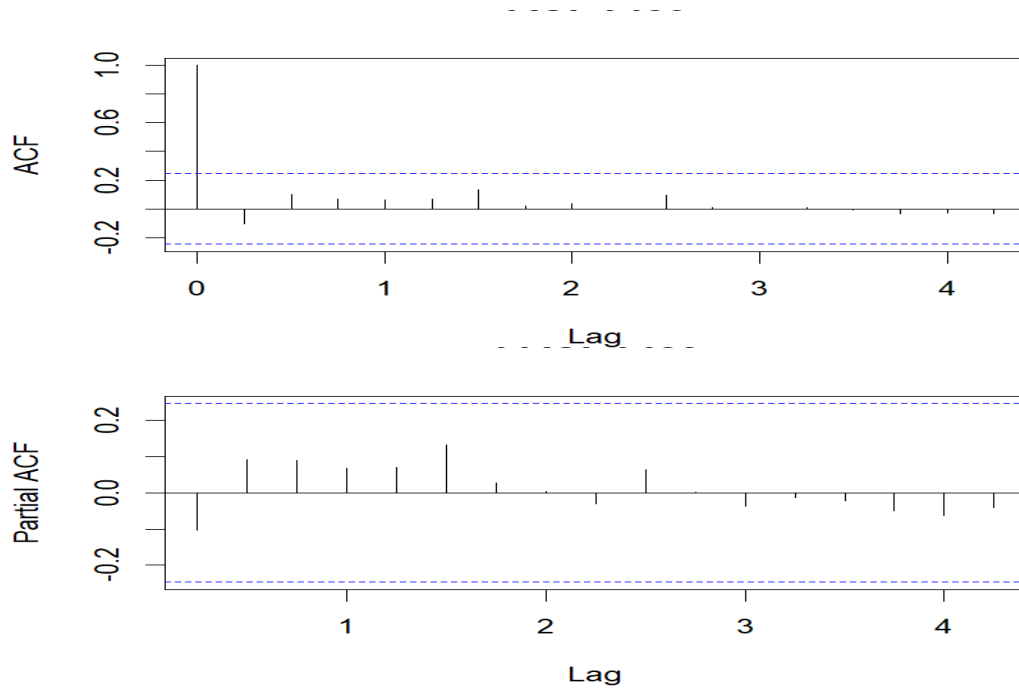


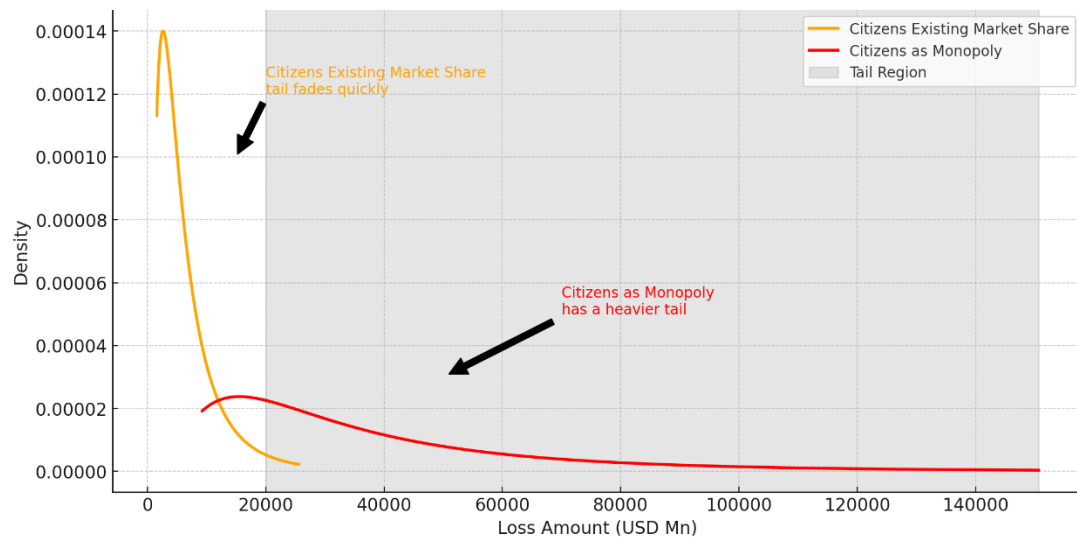
Table 8: Residual Diagnostics: Ljung-Box Test for Autocorrelation (Citizens demand)

Model	Test Statistic	df	p-value
ARIMA (0,2,1)	3.67	7	0.82

Ljung Box test is conducted to test if ARIMA (0,i,1) model exhibits serial correlation. The null hypothesis of the test states the residuals are independently distributed (i.e. no significant autocorrelation). The results suggest of the test suggest that there is no significant autocorrelation as we fail to reject the null hypothesis (p- value greater than 0.05).

Along with the Ljung Box test, Figure 18 also shows that under the ACF plot the first lag has a strong positive correlation, which is expected for a differenced series. However, the remaining lags have low and insignificant autocorrelations as they fall under the confidence bands indicated by the blue dashed lines. This suggests that the residuals do not exhibit any autocorrelations. Similarly, for the PACF plot all fluctuations remain between the confidence bounds indicating no autocorrelation between residuals making the results unbiased.

Figure 19: Comparison of Loss Distributions: Citizens Existing Market Share vs. Monopoly Scenario: Glide Path



Note: The figure compares the probability distribution functions (PDFs) of losses under two scenarios. 1) Citizens existing market share, which is characterized by a quick tail, indicating lower extreme values. 2) Citizens as Monopoly showing a heavier and extended tail, showing a higher probability of extreme loss events. The left fat tail highlights a substantial increase in the risk of extreme losses.

Source: QUASR, Citizens markets share and business overview reports

Figure 19 shows how Citizens risk exposure changes when it transitions from its current market share to monopoly under a strict adherence to the glide path. The red line's heavier tail suggests that under monopoly conditions, Citizens faces significantly greater financial risk from extreme losses, which challenges its financial sustainability. And the extreme losses observed in this scenario are greater than those experiences in case where monopoly exists but premiums are decided based on historical trends.