
Beyond Stability: Antifragility and Knowledge Economies

Recommendations for Arizona

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EXECUTIVE SUMMARY

Antifragility is a term coined by author Nassim Nicholas Taleb to describe a phenomenon whereby a system or actor benefits from, instead of suffers from, disruption. Compared to fragile actors, who seek stability and are damaged by unexpected events, and resilient actors, who endure shocks with little change, antifragile actors seek out disruption as it strengthens their position relative to their current condition. This report examines the economic characteristics of states within this context, focusing specifically on Arizona. Table 1 outlines the features associated with fragile, resilient, and antifragile factors of state economies.

The Antifragility Matrix for State Economies | Table 1

	Fragile	Resilient	Antifragile
Political Attitudes			
Economic Development	Zero-sum view; focuses on businesses	Growth view; focuses on industries	Positive-sum view; focuses on technologies
Risk	Ignores or avoids risk	Mitigates risks	Embraces risk as opportunity
Technological and Economic Change	Embraces stability	Aspires to predict change	Aspires to create change
Public Resources	Conserves resources; scarcity mindset	Reconfigures resources	Invests and transforms resources; abundance mindset
Economic Policies			
Focus on economic policy	Growth through corporate relocations, tourism, real estate, and service industry expansion	Growth through adaptation of existing economic resources	Development by improving enabling conditions for local creation of industries that don't exist yet
Management and Support of Economic Actors	Centralized control but under-resourced	Decentralized control and adequately-resourced	Decentralized control and well-resourced
Role of Tax Policy	Seen as a singularly important policy tool	Seen as one of many policy tools	Not seen as critical to targeted technologies/ industries
Economic Attitudes			
Type of technology in economy	Little, low-value, or mature technologies	Focus on adopting current technologies	Focus on adopting and developing emerging technologies
Labor Force/ Education Attainment	Substitutable, commodified low-skilled labor	Substitutable, commodified high-skilled labor	Configurable, adaptable, high-skilled labor
Business "Stickiness"	Uses incentives to compete with other locations to attract businesses	Attracts businesses through a combination of incentives and economic stability	Attracts and develops businesses that are deeply anchored to local clusters
Connection to Other Regions and Markets	Inward-looking; connections are low-value and underdeveloped	Outward looking; transactional connections	Outward looking; deep economic and cultural connections
Cyclicity	High	Moderate	Small or None

The authors find that the political attitudes, economic policies, and economic attributes of Arizona are largely characterized by fragility and resiliency. To achieve antifragility, Arizona should adopt two sets of policy interventions. The first is greater investment in education, including both the P20 system and workforce development; and in the state's infrastructure. A lack of funding is the cause of Arizona's fragility or resilience across many of the factors, and substantially increasing funding would move Arizona much closer towards antifragility. Secondly, the state should work to broaden its tax base, reduce the centralization around gubernatorial power, and reduce its reliance on cutting taxes and easing regulations to elicit economic growth. Table 2 provides a summary of the ratings that Arizona received for each factor along with the specific steps that it should take to become antifragile.



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Arizona’s Position within the Antifragility Matrix | Table 2

	Fragile	Resilient	Antifragile
Political Attitudes			
Economic Development	Resilient	Focuses on industries, but sectors that have experienced gains primarily service population growth	Invest in human capital and expanding Research and Development (R&D)
Risk	Resilient	Good Budget Stabilization Fund (BSF) balance but 87% of revenue comes from two sources (income and sales taxes)	Broaden the state’s tax base
Technological and Economic Change	Resilient	Develops proactive strategies such as a large BSF yet does not aspire to create change	Enable emerging industries to develop through a highly-educated labor force
Public Resources	Resilient	Conserves resources by cutting taxes rather than investing revenues	Set specific goals and secure the resources necessary to accomplish them
Economic Policies			
Focus on economic policy	Fragile	Uses low corporate taxes and light regulation to drive growth through corporate relocations, tourism, and real estate development	Improve the conditions for the creation of industries that do not exist through greater investments in infrastructure and education
Management and Support of Economic Actors	Fragile	Underfunded civil service and education system under a centralized control	Improve education expenditures while restructuring the education policy system to reduce the centralization around gubernatorial power
Role of Tax Policy	Fragile	Lawmakers view tax policy as a singularly important tool, reducing taxes whenever revenues become available	Develop a strategy to maximize the public’s economic return of investment instead of cutting taxes
Economic Attitudes			
Type of technology in economy	Resilient	Above-average increases in R&D spending	Invest in the research activities of public universities and support their patenting and entrepreneurship activities. Arizona Commerce Authority (ACA) should attract businesses with large R&D expenditures
Labor Force/ Education Attainment	Fragile	Poor educational attainment and low-skill level of workforce	Invest significantly in the state’s P20 system
Business “Stickiness”	Resilient	Reliance on industries that are fueled by population growth	Create pools of highly skilled workers with industry-specific expertise
Connection to Other Regions and Markets	Fragile	Inward-looking economy with weak external connections	Develop a high-tech service economy while improving connections with regional economies
Cyclicality	Fragile	Industrial composition dependent upon population growth and a lack of diversity in the state’s revenue streams	Broadening of the state’s tax base and industrial mix

The notion of instability is often associated with negative connotations, especially when related to economies. Social mistrust of forces that have the potential to act as disruptors has been common throughout history. Luddism, a term now used to describe distrust of new technologies, came from an early 19th-century labor movement that protested the effects of mechanization on textile factories (Andrews, 2019). In the present day, this movement takes the form of individuals attacking autonomous vehicles with knives and rocks as they cruise the streets of Eastern Maricopa County in Arizona, with employees still inside (Romero, 2018). At the same time, even the slightest threat of an economic downturn is enough to send capital fleeing to the bond market. State actors are no different, with governments clinging to dying industries such as coal and governors regaling legislatures with reveries of economic success and stability during the state of the state addresses. However, **economic downturns and disruptions bring opportunities that states often fail to actualize.** The culling of inefficient businesses and dying industries fertilizes the economic landscape for the next generation—yet, the ability for economies to do so is not a given. The capacity of economies to take advantage of economic shocks and thrive from disruption, known as antifragility, can be intentionally cultivated.

The concept of antifragility was developed by the author Nassim Nicholas Taleb. **To describe an actor's ability to cope with disruption, Taleb proposed a central triad: fragile, resilient, and antifragile** (Taleb, 2015). Fragile actors seek stability, as any sort of disruption risks damaging them substantially. Resilient actors endure shocks with little change, positive or negative, to their state of wellbeing. Antifragile actors seek out disruption, as it strengthens their position relative to their current state. While certain components of

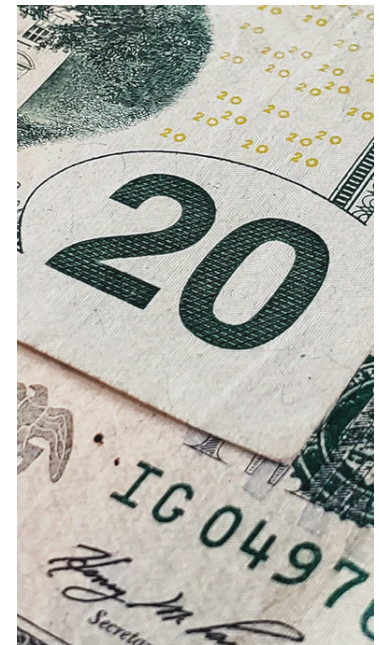
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an antifragile system may suffer during disruption, the system as a whole is better off relative to its previous state.

Taleb's triad can be applied to state economies to evaluate their ability to endure economic shocks. Fragile states do best when the economy is behaving as it should: steady growth with minimal adjustments to the industrial mix. However, any sizable shift in a state's industrial mix or a recession can be enough to send these states into a downward economic spiral. When things do not go as planned, these states suffer. Resilient states do better during trying times. They hedge their bets to ensure the economy continues to hum along, both in good and bad times. What these states possess in dependability they lose in dynamism. Opportunity costs mount as states fail to capitalize on shifts in the economic landscape. Antifragile states succeed in doing just that: they adopt economic development

strategies that produce the regulatory environments and incentive landscapes which, while they may not benefit to the degree that fragile states do during good economic times, thrive during periods of tumult.

The design that best allows states to become antifragile is the knowledge economy. As defined by Powell and Snellman (2004), the key features of a knowledge economy are “production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence” (p. 1). The crux of antifragility is obsolescence, as the emergence of new industries is generally linked to the decline of industries of the past. Knowledge economies rely significantly more on the intellectual capabilities of their economic actors rather than on physical inputs and natural resources. These capabilities are developed through significant investments in human capital. **As the human capital of the knowledge economy grows, the capability of the economy to adapt and capitalize on shocks and disruptions increases.**



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This report examines the state of Arizona within the context of antifragility and knowledge economies. We chose to analyze Arizona because of its diverse economic profile. By certain measures, such as the significant economic damage Arizona suffered during the COVID-19 pandemic and the Great Recession, and the low educational attainment of the labor market, the state appears fragile. Yet at the same time, new industries such as autonomous vehicles are blossoming, an indication that Arizona is poised to achieve antifragility. This report begins by characterizing the concept of antifragility, providing examples for each part of Taleb’s triad. The authors then identify components of antifragility, followed by an examination of Arizona’s economy through the lens of each component. Finally, the report offers a framework for how Arizona can achieve antifragility. The State of Arizona has great potential, but this potential will only be realized if its political leaders choose to invest in its human capital and infrastructure to develop the knowledge economy that will lead to antifragility.

Washington

Population: 7.6 million
GDP: \$613 billion
College Educated: 47%
Median Income: \$38,000
Largest Industry: Construction

West Virginia

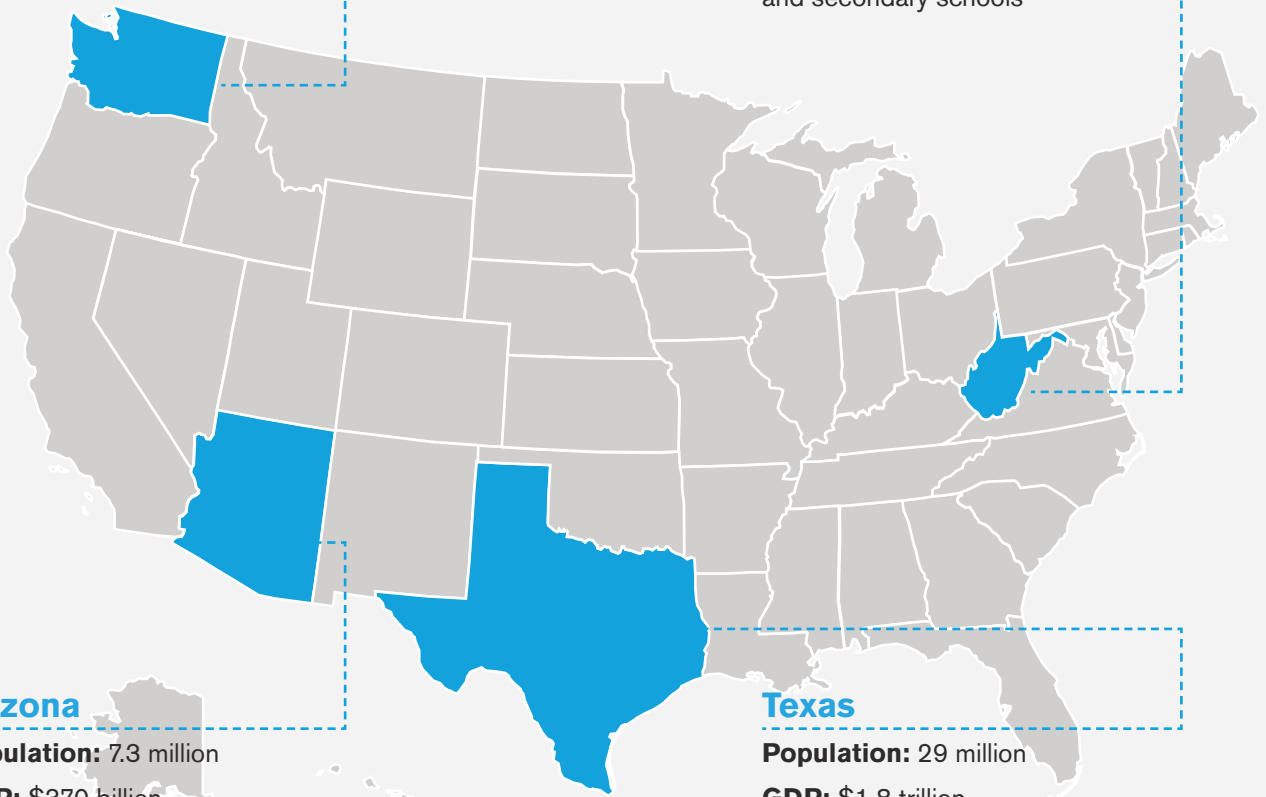
Population: 1.8 million
GDP: \$79 billion
College Educated: 29%
Median Income: \$26,000
Largest Industry: Elementary and secondary schools

Arizona

Population: 7.3 million
GDP: \$370 billion
College Educated: 39%
Median Income: \$31,000
Largest Industry: Construction

Texas

Population: 29 million
GDP: \$1.8 trillion
College Educated: 38%
Median Income: \$32,000
Largest Industry: Construction



ANTIFRAGILE CONCEPT CHARACTERIZATION

Analyzing state economies within the framework of Taleb's triad can be especially useful to policymakers who endeavor to determine the ability of their state to weather volatility. Practicing economic development by prescribing policy interventions to treat specific shortcomings that prevent a state from developing a knowledge economy can be effective in achieving antifragility. Before this is possible, it is important to compare the characteristics of fragile, resilient, and antifragile state economies. The case studies below help to illustrate each of these conditions.

FRAGILE

Fragile actors shy away from disorder. Just as a ceramic mug best retains its structure while resting undisturbed on a shelf than it does during an earthquake, fragile organizations and economies prefer tranquility over disruption. **Fragile actors are vulnerable to volatility, with shocks bringing greater harm as their intensity increases** (Talib, 2014, p. 268).

One example of a fragile state economy is West Virginia. West Virginia has historically had a weak economic standing for a number of reasons, such as its mountainous terrain which makes it a challenge to build new industries and limits its agricultural production (Martis and Clagg, 2019). In the pre-World War II era, West Virginia compensated for these limitations by developing a successful coal mining industry that acted as an integral part of the state's economy. However, after the war, the consumption of petroleum and hydroelectric energy began to outpace coal (U.S. Energy Information Administration, 2011). The decline of coal's share of energy production is a result of changes in energy technology and regulation due to concerns about its harmful environmental effects (Martis and Clagg, 2019)

and advancements in mining mechanization that produce more coal but require fewer workers. This disruption led to the closure of mines and significant job losses, inducing a massive, prolonged migration out of the state. In addition to reducing the stability of the labor market, the new coal mining technology harmed West Virginia's landscape. Mechanization relies on surface mining instead of deep mining, and while this new technique is safer than deep mining, a method called "mountaintop removal" is required to extract the thin layers of surface coal located on the mountaintops of West Virginia—which is devastating to the landscape and now restricted by environmental laws, further decreasing coal's contribution to the state's economy.

West Virginia was highly dependent on coal mining and not prepared for the shifts that occurred from changes in the industry. The Appalachian Regional Commission (ARC) was initiated at the end of Lyndon B. Johnson's administration to boost the economy of the Appalachian region after it was identified as lagging in economic development. Through the ARC, West Virginia has moved away from coal and the industrial economy to a service economy, pursuing tourism as the primary means to expand in the new kind of economy. To pursue this shift, West Virginia invested in developing infrastructure and transportation, which has only been possible due to more recent advancements in technology.

Ultimately, over-dependence on coal and lack of other options for West Virginia made the state fragile when coal mining demand diminished. It was only once the state started to invest in itself and diversify its industrial mix that its economy started to become more resilient. However, West Virginia's rate of economic growth still lags compared to other states and is considered to be one of the weakest economies in the country. In order to establish a stronger economy, the state must invest more in the creation of an economy based on knowledge and information.

RESILIENT

Resilient actors are neither harmed nor helped by volatility and disorder (Taleb, 2014, p.17). Just as a sturdy boulder will likely remain intact whether it is left alone or sent rolling down a steep hill, resilient organizations and economies weather disruption with minimal effect on their larger operation. Taleb describes resilience as “a state of immunity from one’s external circumstances, good or bad, and an absence of fragility to decisions made by fate” (p.153). However, no organizations or systems are impervious to external forces. Rather, this paper will define resiliency as “the ability to endure disruption and volatility with minimal effect on an entity’s ability to act.” This can be achieved through a variety of mechanisms but is often achieved through the diversification of economic actors.

Resilient economies are characterized by their ability to remain intact and weather disruptions. During the Great Recession, an iconic test of economic health, the State of Texas proved its resiliency. Texas did not experience the effects of the recession until the later part of 2008 and had experienced an energy boom earlier that year. The state was able to bounce back from the effects of the recession due to its relatively stable real estate market, an increase in manufacturing and export, and a diverse industrial mix.

Texas did experience a slowdown in revenues due to its reliance on property taxes combined with a decline in real estate appreciation. However, banks maintained conservative and unexotic lending practices (Thompson, 2010) and an overall diversification from a concentration of real estate and financial services helped avoid significant harm to the economy caused by the housing crisis that many other states experienced. The

increase in manufacturing and export allowed Texas to sustain its economy during the recession. Texas was the largest exporting state, with its export of goods rising 24.3% between 2009 and 2010, by \$29 billion (Gross, 2010). Texas’s export of goods such as electronics, chemicals, and machinery contributed more to the state’s revenue than its export of oil. The manufacturing of these goods during the recession also contributed 700,000 jobs to the economy (Gross, 2010). While other states such as California, Arizona, and Nevada suffered great employment losses, three out of the five most resilient major metropolitan areas for employment were located in Texas- McAllen (#1), Austin (#3), and San Antonio (#5). Texas’s mix of industries, including energy, education, technology, and military spending allowed it to weather the recession and maintain economic stability (Texas Comptroller of Public Accounts, n.d.). Energy sources, especially wind, also drove Texas’s economy, with energy production rising 35% between 2004 and 2008 (Gross, 2010). Texas’s wind production runs on an electricity grid that the state owns, allowing it to deregulate the power markets, build new transmission lines without federal jurisdiction and without consulting other states (Gross, 2010), and pursue alternative energy sources.

Texas proved to be a resilient economy due to its ability to adapt. Texas was able to grow its economy during the recession through existing industries and reconfigure its resources to meet the needs of the economy. While many states faced devastating losses, Texas was able to sustain the needs of the people and the economy while relying on existing economic policies to move beyond the recession with minimal loss.

ANTIFRAGILE

Antifragility is the ability of an actor to benefit from shocks or disruption. For example, while an individual restaurant may be fragile to disruption, and agglomeration of actors within an industry can be antifragile. When a recession strikes, some restaurants close their doors, while others develop new concepts, serving a clientele who now seek a cheaper option for food or evening entertainment. As a whole, the industry emerges stronger. **Antifragile systems structure themselves so that they have more to gain than to lose from unexpected events, creating a disposition towards external volatility** (Taleb, 2015, p.175).

The state of Washington has faced several disruptive economic events that would have been devastating to a fragile economy. In the past, Washington, similar to West Virginia, was dependent on the coal industry (Augustyn et al., 2019). However, unlike West Virginia, Washington's terrain provides a much richer assortment of natural resources, allowing industries such as agriculture, fishing, and forestry to thrive. These natural resources, along with being a coastal state, provide the landscape for a much richer industrial mix.

Since the 19th century, Washington had been highly dependent on agriculture, forestry, fisheries, and mining. Developments in the 20th century, such as the shift from small farms to large farms, the decrease in forestry activities due to environmental restriction, and the decrease in coal production and demand, caused significant disruptions to Washington's economy. However, instead of these disruptions resulting in a mass migration from Washington, new industries emerged and several existing industries experienced growth.

Among these emerging industries was the aircraft and aerospace sector, including the airplane manufacturer Boeing, formerly headquartered in Seattle, which opened assembly plants in Everett and Renton. Additionally, the U.S. Navy facilities on the Puget Sound engaged in the construction, repair, and demolition of ships and submarines, bringing more high-skill jobs to the state. The oil refineries on Puget Sound also produced significant contributions to Washington's economic stability through industrial diversity. The 1970s saw the development of high-technology manufacturing of electronic systems and computer software, including the establishment of the Microsoft Corporation in Redmond. These industries in Seattle encouraged the rapid development of hundreds of small businesses, and new wealth, particularly in the 1990s.

At the turn of the 21st century, the high-technology and internet industries saw a significant economic downturn, also known as the dot-com bubble. While the economic recovery was slow, the emergence of Amazon, headquartered in Seattle, as an e-commerce titan breathed new life into the economy. While the state experienced economic hardships during the Great Depression like the rest of the United States, it emerged stronger than before, surpassing the national averages for several economic indicators (Rolfes et al., 2019), including attainment of bachelor's degrees, incoming migration rates, spending and investment in Research and development (R&D), patents issued, venture capital investment, birth rates, households with an internet connection, high-wage industry growth, per-capita income and growth rates, total employment growth rate, average wages, and real per-capita GDP. Washington's ability to adapt and capitalize on changing economic conditions signifies Washington's success to establish an antifragile economy.

COMPONENTS OF ANTIFRAGILITY

The fragility of states is largely determined by how elected leadership engages with the economy. While partisan beliefs often have a meaningful impact on policy design, the social philosophy of elected leaders along with the formulation and administration of laws can shape the economic landscape in meaningful ways. To that end, this paper argues that three different forces are responsible for the fragility, resiliency, or antifragility of a state economy. These forces are political attitudes, economic policies, and economic attributes.

POLITICAL ATTITUDES

Political attitudes held by policymakers (and, in turn, the citizens who elected them) lay the groundwork for the other two forces. These attitudes are the “why” of statecraft, influencing not only the laws that are passed but also how they are executed and, to a certain degree, the ways in which the judiciary enforces their relationship with the existing legal framework. **Political attitudes contribute to the antifragility of an economy through four dimensions:**

- 1. Economic development:** The lens through which political leaders view achieving economic growth.
- 2. Risk:** The role that risk plays in a state’s strategic planning.
- 3. Technological and economic change:** How a state approaches the changes brought about by technology and macroeconomic forces.
- 4. Public resources:** The way that the state uses the resources at its disposal.

ECONOMIC POLICIES

The political philosophy of a state influences how it shapes and interacts with its economic landscape. Economic policies are the “how” of statecraft; although the belief that community wellbeing comes from the success of actors within a state is common, the ways in which the state should interact with these actors is at the core of debates around economic development. **Engaging this force requires the examination of three different factors:** Focus of economic policy, management and support of economic actors, and role of tax policy.

- 1. Focus of economic policy:** The goal that the state’s economic policy aims to achieve; whether the state primarily aims to merely improve economic metrics focused on the present or instead endeavors to lay the groundwork for the industries of the future.
- 2. Management and support of economic actors:** The degree of control of and investment in state-sponsored economic actors.
- 3. Role of tax policy:** The approach that the state takes in its design and implementation of tax policy.



ECONOMIC ATTRIBUTES

The economic attributes that a state possesses are the consequence of political attitudes as well as economic policies and macroeconomic forces. This is the “what” of statecraft: the landscape that economic actors and citizens interact with. Economic attributes are traditionally measured by descriptive statistics including GDP, per-capita income, and unemployment, but the health of an economy and the ability to grow from disruptions rather than suffer are determined by more complicated metrics. **The five factors of the economic attributes force include:**

1. **Types of technology in economy:** The degree to which the economy incorporates existing and emerging technologies.
2. **Labor force/educational attainment:** The human capital of the labor force.
3. **Business stickiness:** How businesses are compelled to remain in the state, whether from incentives or from being anchored to local clusters.
4. **Connection to other regions and markets:** Whether a state is inward-looking or outward-looking and how it connects to other regions.
5. **Cyclicity:** The volatility characterizing a state's economic growth.

THE ANTIFRAGILE MATRIX

It is possible to define the characteristics of fragile, resilient, and antifragile states for the factors that comprise the aforementioned three forces within each state.

- Fragile states are focused on short-term success, and fail to make investments, both fiscally and politically, which lead to long-term growth.
- Resilient states are focused on the short term and the long term but design their political and economic systems in a way that hedges against risk rather than embracing it.
- Antifragile states both meet short-term needs while designing their economies to capitalize on uncertainty and disruption.

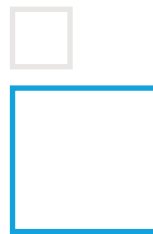


Table 3 extrapolates the approach of fragile, resilient, and antifragile states for each of the factors of the three forces.

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EXPLORING ARIZONA'S POLITICAL AND ECONOMIC SYSTEMS

These characterizations of the driving forces and defining factors behind fragile, resilient, and antifragile state economies provide a context for examining Arizona's political and economic systems. Arizona is analyzed here according to each of the three enabling factors, along with descriptions of strategies to move toward antifragility by focusing on long-term growth and realizing benefits from economic disruptions.

POLITICAL ATTITUDES

Copper was discovered in Arizona in 1854, shortly after its territory had been ceded to the United States in 1848. Copper, silver, and gold mining, in addition to the migration from the Eastern United States to California via the Gila Trail and the Santa Fe intercontinental railroad, led to Arizona's population growth through low-skilled laborers (Secretary of state, n.d.). Copper mining remained Arizona's premier industry in the 1950s; when air conditioning and refrigeration became widespread, Arizona's population grew rapidly, from 750,000 in 1950 to 1.3 million in 1960 (Forstall, 1995), to 7.2 million in 2018 (U.S. Census Bureau, 2018).

Arizona's significant, sustained population growth led to an economic development approach focused on servicing the needs of newcomers. Seventy years of this economic focus has had a profound effect on the attitudes held by Arizona's political leaders. Designing an economy that continues to attract regional migrants has become a regular tactic to continue to fuel economic growth. The political attitudes of leaders and their effect on Arizona's economic development are analyzed here through four lenses.

Economic development

Arizona's political outlook on economic development focuses on growing industries. In its 2018–2022 business plan, the Arizona Commerce Authority (ACA), a state body that works to strengthen and grow the state's economy, listed one of its five-year goals as “lead[ing] efforts to create 80,000 projected new jobs with a focus on high-wage target industries” (Arizona Commerce Authority, 2018). ACA goes on to list aerospace and defense, bioscience and health care, business and financial services, film and digital media, manufacturing, and technology and innovation as its target industries.

This focus on industries is indicative of resiliency, with technology and innovation nodding towards antifragility. However, by many measures, the state's economic development has traits of fragility. From May 2020–May 2021, there was an increase of 163,800 jobs. (Office of Economic Opportunity, 2021). These gains, however, were made primarily in leisure and hospitality (63,200 jobs), trade, transportation, and utilities (51,600 jobs), and education and health services (26,800 jobs). Many of these jobs service continual population growth, a trait of fragility. Previous research has shown that Arizona's industrial mix is weak relative to knowledge economy states, due mainly to its low sectoral shares in high-wage, high knowledge service sectors (Rex, 2003a). Consequently, other aspects of Arizona's economic growth have been limited. Arizona saw an increase of only 3.6% in real per capita personal income in 2019 (Bureau of Economic Analysis, 2020). Preliminary 2020 numbers put Arizona 42nd in the nation for per capita personal income (Bureau of Economic Analysis, 2021). The state, which does not have a highly skilled workforce, has benefitted from attracting better-qualified in-migrants, but this dependence on population growth to supply high-skilled individuals contributes to its fragility (Rex, 2014).

For Arizona to transition to an antifragile economic development strategy that focuses on technologies, it must develop its stock of human capital internally by strengthening the education system and expanding job training programs (Hoffman and Rex, 2010b). Research and development (R&D), both in the private sector and the public sector, is also important as R&D provides often provides spillover benefits to other users, benefiting the economy as a whole (Blakemore and Herrendorf, 2009). Technology created through cooperative R&D programs between publically-funded research universities and private organizations raises the competitiveness of local firms while also benefitting the region's human capital (Hogan, 2016). **Transitioning to a knowledge-based economy driven by science- and technology-based jobs are essential not only to remain competitive (Hoffman and Rex, 2009b) but to capitalize on the disruption that future technological innovations will inevitably cause.**

Risk

In the past decade, Arizona moved from a fragile to resilient outlook in how it contends with risk. Arizona's budget stabilization fund (BSF), commonly known as its "rainy-day" fund, is the state's primary mechanism for hedging against economic uncertainty. Prior to the Great Recession, despite experiencing surplus revenues (Associated Press, 2010), the BSF remained below the 7% statutory limit (Arizona Legislature, 2019). This disregard for risk had severe consequences. Left with only a \$676 million balance in the BSF to resolve a \$2 billion revenue shortfall, the state had to impose significant program cuts to healthcare, education, and community services (Associated Press, 2010). The damage caused by the recession along with the state and municipal budget cuts had significant economic consequences for residents. From 2009 to 2014, Metro Phoenix lost 100,000 construction jobs and the poverty rate increased from 26.5% to 29.7% (Hansen and Wiles, 2015).

Ten years after the end of the Great Recession, Arizona is still struggling to prepare for the next downturn. The BSF balance at the end of FY 2018 stood at \$457 million (Joint Legislative Budget Committee, n.d.), far short of the estimated \$893 million that would be needed for the state to weather a severe recession (Elder, 2016). In 2019, the state legislature invested significantly in the fund, bringing the balance up to over \$1 billion (Office of the Governor, 2019). In light of the COVID-19 pandemic, the state utilized \$55 million to pay for public health expenses, leaving the BSF balance at \$954 million in January 2021 (Governor's Office of Strategic Planning and Budgeting, 2021). Despite this more-than-doubling of the BSF, Arizona remains vulnerable due to its lack of diversity of revenue streams. Out of the \$10.6 million in revenues in FY 2018, \$4.5 million came from individual income taxes and \$4.8 million came from sales and use taxes (State of Arizona, 2019). 87% of Arizona's revenue is therefore derived from two sources which are volatile in times of economic distress. While Arizona's current BSF balance hedges its risk, its dependence on income tax and sales and use tax revenues increase its fragility in the face of economic distress.

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To become antifragile and embrace risk as an opportunity, Arizona must work to diversify its revenue stream and broaden its tax base. To explore methods by which the state can expand its revenue stream, the state should create a task force that can look into possibilities such as increases to corporate income taxes, severance taxes, motor vehicle taxes, and other taxes where Arizona's tax receipts are lower than the national average when compared to gross tax revenues (U.S. Census Bureau, 2019c). The base of the transaction privilege tax (also known as the sales and use tax) to include services can also be broadened, as goods only account for 30% of personal consumption expenditures nationwide (Drenkard, 2017). Doing so would require voter approval, as Arizonians adopted a ballot measure in 2018 prohibiting any new taxation of services (Kwok, 2018). Failing to act will be costly, as a small tax base is both inequitable to those on whom the tax is imposed and unwise, as a smaller tax base leads to more volatility during downturns. The state has significantly improved its approach to economic risk since the last recession, but much more must be done to realize antifragility.

Technological and economic change

Prior to the Great Recession, Arizona had a fragile outlook on technological and economic change. The state government embraced stability, cutting taxes significantly while the BSF remained stagnant (Associated Press, 2010; Arizona Legislature, 2019). Job quality is harmed during and after recessions (Rex, 2005). As a result, the Great Recession likely caused a decline in job quality in Arizona, harming regional technological progress and reducing Arizona's advancement towards a knowledge economy. At the same time, revenue contributions to higher education in Arizona dropped precipitously during the Great Recession, even as the university system saw an increase in demand (Hill, Hoffman, and Rex, 2008). Reduction in job quality and the

number of people obtaining an education will have long-term negative economic outcomes including decreased productivity as well as fewer economic advantages in the emerging knowledge-based economy.

Arizona has since moved to resiliency and increasingly aspires to anticipate change. The recent influx of cash to the BSF shows that the state is developing proactive strategies for the next economic downturn. At the same time, **the state has failed to make the necessary investments in order to create an antifragile knowledge economy which gains from economic disruptions, and in turn attempts to create such disruptions themselves.** When these disruptions are created internally (such as the development of the self-driving car industry), the state benefits from the economic growth that occurs from the new industries creating the disruption. When this disruption occurs externally, a knowledge economy can rapidly re-skill and reinvest capital in a way that capitalizes on the changes and, in turn, experiences more growth than it would have otherwise. Creating such a knowledge economy requires significant investments in infrastructure and education, which develops a highly-educated and skilled labor force and creates an environment that enables emerging industries to develop.

Public resources

Arizona's disposition to conserve its public resources leads to its classification of fragile within this factor. Before the late 1960s, Arizona's revenues and expenditures relative to personal income were above the national average (Hoffman and Rex, 2015b). This level was similar to the US average up until the early 1990s when Arizona Governor Fife Symington enacted hundreds of millions of dollars of tax cuts (Associated Press, 2010), followed by more cuts from Governors Jane Hull and Janet Napolitano. Revenues declined sharply following the recession, yet this did not stop Governor Doug Ducey from

pledging to cut taxes each year in office (Blair, 2016). The state now takes in approximately \$3 for every \$4 of real revenue that it had in FY 2007 (Wells, 2018).

This conservative approach to public resources has contributed to Arizona's economic fragility. Numerous public institutions have suffered from reductions in public resource spending, including related to transportation and infrastructure (Hoffman and Rex, 2008a); corrections; disabilities (Hoffman and Rex, 2010a); K–12 education, which has lower than the national average on per-pupil spending and funding (Hoffman and Rex, 2016d); and higher education, where tuition has increased (Hoffman and Rex, 2016d). Under-investment in these services contributes to Arizona's high poverty rate (Hoffman and Rex, 2009a); low per capita personal incomes (Hoffman and Rex, 2017); and demographic challenges that affect educational achievement for children, including "low educational attainment of their parents, and lesser frequency of full-time, year-round employment of their parents" (Hoffman and Rex, 2009a, p.1).

Arizona can move towards antifragility by investing and configuring its resources to form a knowledge-based economy.

Transforming Arizona's economy in this way requires significant expenditures in education and related technological infrastructure (Hoffman and Rex, 2010a). Failing to invest in education, along with job training and physical infrastructure, will leave the state fragile and at a significant disadvantage to its peers (Hoffman and Rex, 2016d). Becoming a knowledge-based economy will not happen by accident. The state must set specific goals, determine the actual cost of accomplishing them, and secure the resources necessary to meet that cost. Only the methodical use of state resources will lead Arizona to become antifragile.

ECONOMIC POLICIES

Arizona's economic policies are borne out of the political attitudes held by its leaders. Although Arizona's political leaders generally recognize that focused attention is needed for Arizona to lead the development of the technologies of the future, many take an overly conservative approach to the use of public resources that prevents the state from realizing these goals. While Arizona attempts to attract emerging, high technology industries, it also attempts to differentiate itself as a low-tax, low-regulation state, and economic policy is shaped accordingly. Arizona's economic policy, and the factors that contribute to Arizona's fragility, are examined below.

Focus on economic policy

Arizona's focus on using low corporate taxes and light regulation as a driver for businesses leads to a fragile focus on economic policy. The ACA highlights Arizona as one of the lowest-cost environments for doing business in the country due to its low taxes and business-friendly regulations (Arizona Commerce Authority, n.d.). In addition to pursuing growth through corporate relocations, the state has a significant dependence on tourism and real estate industries. In 2017, the real estate industry accounted for 14.1% of Arizona's total GDP, higher than the pre-recession contribution of 13.6% in 2007 (Bureau of Economic Analysis, 2019). In 2018, the travel industry had a higher GDP than microelectronics, aerospace, agriculture, and mining, resulting in its contribution of more than 6.5% of all state and local tax revenues (Dean Runyan Associates, 2019). While this industry shrank during the COVID-19 pandemic, bipartisan support of two bills in the Arizona legislature giving cities and towns the power to create tourism marketing authorities show the state's reliance on the industry for economic growth (Zambrano, 2021).

Arizona's reliance on corporate relocations, tourism, and real estate development further exacerbates its fragility. **To become antifragile, the state must instead focus on improving enabling conditions for the creation of industries that do not yet exist.** This is done by investing in infrastructure and creating a knowledge-based economy. While a significant number of infrastructure projects have been proposed to meet the growing needs in the state, a large funding gap prevents these projects from moving forward (Arizona Section of the American Society of Civil Engineers, 2020). Higher education is especially useful to the creation of human capital, forming a knowledge economy (Hogan, 2011), and creating an advantage for nearby businesses and industries (Hill, 2017). The emergence of the autonomous transportation industry in Arizona is an example of why investing in infrastructure is important. Industry-friendly regulation played a key role (Kang, 2017), but so did the health of the Phoenix metropolitan area's transportation infrastructure (Vanek, 2019). However, while Arizona's most populous county has invested significantly in infrastructure, the rest of the state lags far behind (Brown, 2019). In order to continue to grow future industries, the state must make investments both in transportation and education.

Management and support of economic actors

Arizona's state-sponsored economic actors are largely underfunded while simultaneously under largely centralized control, creating economic fragility and creating significant opportunity costs. Arizona's civil service has shrunk by 15% since 2008 while its population grew 14% during the same period (Oxford and Polletta, 2019). Arizona's education funding for FY 2019 was \$1 billion less than pre-recession levels (Altavena, 2019). Other agencies have seen funding cuts that have not been restored, such as the Department of Environmental Quality (Kelderman, Schaeffer, Pelton, Phillips, and Bernhardt, 2019) and the Department of Child Safety (Pitzl, 2019).

The lack of support for Arizona's education system has significant consequences. Enrollment at the state's public universities has grown significantly and the costs of higher education continue to increase, yet state support of higher education has not kept up with these increased costs (Hoffman and Rex, 2020). Centralized control of the education system is also an issue. While Arizona's Superintendent of Public Instruction is an elected position, the office serves mostly as an administrative role (Secretary of State, 2016). The actual education policymaking

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bodies for the state are the legislature, the State Board of Education, the State Board for Charter Schools, and the Arizona Board of Regents. Aside from the legislature, the members of all of these bodies are appointed by the governor (the governor and the superintendent of public instruction also sit on each of these boards). Centralized control of the education policymaking bodies risks pedagogical homogenization. Given the increasingly complex human capital needs of our economy, a lack of diversity of perspectives among the governing bodies responsible for developing the systems that develop human capital may stifle innovation and lead to suboptimal outcomes.

To move towards antifragility, Arizona must significantly increase revenue investments in its economic actors, especially education.

Low educational attainment, educational achievement, and high school graduation rates must be improved (Hoffman and Rex, 2010c). Higher education has been especially underfunded since the Great Recession, with community colleges receiving most funding from local sources and very little from the state (Hoffman and Rex, 2016). Arizona must find ways to significantly improve revenue for the state's education system. Additionally, the state would benefit from restructuring its education policy system so that it is less centralized and less influenced by gubernatorial power. Allowing the public to elect policymakers in the Arizona State Board of Education, the Arizona State Board for Charter Schools, and the Arizona State Board of Regents will enable each agency to act with political autonomy. A decentralized, well-funded education system is key for Arizona to move towards antifragility.

Role of tax policy

Arizona lawmakers view tax policy as a singularly important policy tool, contributing to the fragility of the economy. Tax cuts over the past 25 years have at times reduced revenues to historic lows (Hoffman and Rex, 2008c). Policymakers regularly champion tax cuts when extra revenues become available instead of investing those resources. Governor Doug Ducey made annual tax cuts part of his campaign (Blair, 2016) and has enacted multiple tax cuts during his administration (Fischer, 2015; Gleason, 2016). When presented with a potential revenue increase of \$300 million per year due to the removal of many deductions by the Tax Cut and Jobs Act, along with the ability to tax online sales resulting from the Supreme Court's 2018 ruling in *South Dakota v. Wayfair*, Arizona lawmakers decided to reduce taxes by the same amount (Duda, 2019).

Arizona policymakers often argue that tax cuts are a means for economic growth, but no empirical evidence exists that this is the case (Hogan, 2016). The significant loss of revenue due to these tax cuts has mandated reductions in spending. Education suffered significant losses from the billions of dollars cut from the state budget over the years. Between FY 1993 and FY 2007, education expenditures fell by 14% (Hoffman and Rex, 2018). Expenditures on education fell an additional 3% between FY 2007 and FY 2015. Education affects the health of an economy through the skill level of its citizens, so a lack of state investment can have detrimental effects. State and local taxes, meanwhile, have only a small effect on economic growth because they are not a significant expense to either households or businesses, unlike federal taxes (Rex, 2016). **As a whole, economic performance in Arizona has not been stronger since the many tax cuts since the 1990s have gone into effect.**

Arizona can adopt an antifragile framework by viewing tax policy as a means to an end rather than an end itself. Tax policy is an inefficient way of stimulating the economy. Rather, investing in infrastructure and education leads to greater returns on economic growth (Hoffman and Rex, 2008c). This concept is not foreign to Arizona voters, who in 2020 passed Prop 208, raising the tax rate on incomes over \$250,000 by 3.5 percentage points with the funds being invested in K–12 education (Pitzl, 2021). The in-state multiplier effect of government spending is no less, and is likely higher, than that of private-sector spending. Instead of cutting taxes, Arizona's leaders should develop a policy strategy that maximizes the public's economic return on investment, and the subsequent taxes should be equitable and from a diverse tax base.

ECONOMIC ATTRIBUTES

Whereas Arizona's political attitudes are mostly resilient, its economic policies are fragile. The state's tendency to conserve resources instead of investing them in education and workforce development while attempting to grow its economy through tax cuts and lax regulation results in an under-skilled workforce. The shortage of highly skilled workers hampers the growth of new industries, causing much of the economic

expansions enjoyed over the past decade to come from industries that service Arizona's growing and aging population. When growth slows as a result of economic disruptions, these industries suffer, setting the stage for fragility. It is within this context that the attributes of Arizona's economy are examined.

Type of technology in economy

Arizona's current research and development activity credits its resilient position in the types of technologies in its economy. In 2018, \$7 billion in federal and private funds were spent on research and development in Arizona (National Science Board, 2018). While this is a small fraction of the \$495 billion spent on R&D across the United States, Arizona's percent increase in R&D spending from 2000–2015 was 64%, far higher than the national average of 34%. Arizona's universities comprise a significant portion of the money spent on research in the state. Arizona's public universities spent more than \$1.36 billion on R&D in 2018 and plan on increasing this amount to \$1.6 billion by 2025 (Arizona Board of Regents, 2019). This mix of R&D by the private sector and by universities is beneficial, as most basic research is done by universities and most applied research and development is carried out by businesses (Hill, 2006). This reflects an efficient division of labor, as professors who perform research at universities often lack the market perspective to make good commercial judgments,

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and firms face difficulties in gaining commercial value from basic research findings. Recently, there has been an emphasis on joint research ventures between private organizations and research universities, increasing the application of use-inspired research in the state.

With respect to technology, transitioning from resilience to antifragility would not be overly burdensome for the state. While R&D expenditures by the federal government, both military and non-military, have fallen, increases in the private sector of R&D expenditures along with a growth in academic expenditures—from 0.22% of GDP in the 1970s to 0.30% in 2006— have offset the federal cuts (Hill, 2006). To further contribute to R&D growth, the state should invest significantly in research activities undertaken by public universities and provide additional support for patenting and entrepreneurship activities, which help bring research findings to market more expediently. The Arizona Commerce Authority should also prioritize attracting businesses and industries which have large research and development expenditures, which will increase R&D activity for the state and create spillover benefits for other local economic actors.

Labor force/educational attainment

Arizona's economy is made more fragile by the poor educational attainment and low skill level of its workforce. While 32% of those over 18 in the United States have at least a bachelor's degree (U.S. Census Bureau, 2020), only 29.5% of those over 25 living in Arizona hold the same (U.S. Census Bureau, 2019b). Over time, the percentage of Arizona's workforce that is college-educated has increased, but these gains lag behind the growth in tertiary education increases in the U.S. as a whole (Hoffman and Rex, 2015a). Arizona's position as a less-educated state may be

in part due to its below-average job quality, which disproportionately attracts a workforce with lower levels of education; leads to the creation of lower-wage jobs; and causes skilled workers to relocate to states with higher-wage jobs.

In order to develop an antifragile economy, Arizona must invest significantly in the preschool through college (P20) education system. While educational attainment is measured by high school and college graduation completion levels, early childhood education is extremely important in future academic and career success (National Education Association, n.d.). Additionally, a well-funded college system can improve access and institutional support for those who struggle to complete two- and four-year degree programs. Less than 20 years ago, Arizona's public investment in higher education rivaled many other states; in 2003, the public support for higher education in Arizona was considerably higher than the national average (Rex, 2005). While public investment has since decreased, educational attainment of the workforce has taken on added importance over time, as the economy has shifted from manufacturing to being innovation and information (Hoffman and Rex, 2015a). Educational attainment benefits not just the well-educated: the sharing of knowledge and skills across workers improves productivity, translating into higher output and earnings (Hoffman and Rex, 2014). The only way for Arizona to benefit from a highly-educated workforce and realize these gains is by investing in education, both at the early childhood and higher education levels.

Business stickiness

Arizona's reliance on industries that are fueled by population growth results in business stickiness, a mark of resiliency. These industries, which include education and health services; construction; trade, transportation, and utilities; and leisure and

hospitality, derive their demand from population growth rates (Office of Economic Opportunity, 2019). They thrive in times of economic stability and are not susceptible to being lured away through tax breaks and other economic incentives.

The push for the cultivation of high-technology industries by the Arizona governor and the ACA is helping to move the state in an antifragile direction. The translocation of Uber's autonomous vehicle division from California to Arizona, along with the announcement that the luxury electric car manufacturer Lucid Motors would open a large factory in Casa Grande, are examples of this drive to attract high-tech companies. However, the methods by which these companies were attracted are not sufficient to create an antifragile economy where businesses are deeply anchored to local clusters. Uber moved its autonomous vehicle operations from California to Arizona due to a disagreement with California regulators (Bensinger, 2016). Since then, Waymo, General Motors, Ford, Kroger, and Ryder have begun testing self-driving vehicles in Arizona (Wiles, 2019). However, they did not choose Arizona as a location simply for the favorable regulatory climate. Thanks to the investments by municipal governments within Maricopa County, the infrastructure is much better than the rest of the state (Vanek, 2019). Waymo also credited metropolitan Phoenix as an "innovation-minded region that shares our vision of improving mobility for all" in explaining the expansion of its operations in Arizona (Randazzo and Collom, 2019). Lucid Motors decided to base its operations in Arizona in part due to the \$46 million in subsidies offered by the state (Hansen and Wingett Sanchez, 2016).

In order to develop an antifragile position for business stickiness, Arizona must focus more on creating the optimal conditions for the development of high-technology industries, rather than focusing exclusively on attracting businesses. This can be accomplished in part by developing a high-skilled workforce. A 2012 survey found that a large percentage of companies viewed relocation as either a "critical" (43%) or "important" (49%) aspect of their talent management strategy (Professional Services Close-Up, 2012). A large pool of high-skilled laborers attracts new industries, and other members within that industry continue to locate within that region due to the industry-specific expertise which exists within the local human capital. Arizona must do more to develop its workforce if it hopes to realize the goals which it has set.

Connections to other regions and markets

One of the core economic attributes within metro economies is the ability to connect to other regions and markets. In a fragile metro economy such as Arizona, connections are often low priority as institutions are more inward-looking and underdeveloped. This is a critical issue in Arizona mining communities, which continuously sell goods and services to each other rather than outside partners (Hoffman and Rex, 2016b). In other areas, Arizona has traits of resiliency in its connection to other markets. Arizona has enjoyed success in attracting workers from other states, compensating for the lower educational attainment of its populace (Hoffman and Rex, 2012a). This ability to attract outside workers, however, should not be taken for granted. Arizona also serves as a major transportation hub for trade and transit from Mexico, California,

Nevada, and other major regional economic actors. Along with Arizona's proximity to Mexico, these capabilities helped Governor Ducey to develop a working relationship with Claudia Pavlovich, the governor of the Mexican state of Sonora (Associated Press, 2019).

Arizona can establish an antifragile connection network to other regions and markets by developing its knowledge economy. Arizona has limited manufacturing other than high-technology electronics and aircraft, meaning that the decline of the American manufacturing sector due to lower trade barriers has minimal effects on the state. Instead, developing a high-tech service economy can complement lower socioeconomic countries and regions such as Mexico, while enabling new and innovative ways to improve economic connections with regional trade and transportation partners along with developing connections with other regions.

Cyclicalities

The industrial composition of Arizona's economy, coupled with the lack of diversity in the state's revenue streams, results in a highly cyclical economy which contributes to the state's fragility. Much of Arizona's economic growth in 2019 came from industries that service Arizona's population growth, including health services; construction; trade, transportation and utilities; and leisure and hospitality. However, during times of economic downturn, birthrates decline and consumer spending power drops, harming industries that depend on economic stability. One such industry is real estate. During the Great Recession, Arizona lost over 100,000 construction jobs (Hansen and Wiles, 2015). The state's dependence on copper mining also contributes to volatility, as commodity prices experience high cyclicalities.

Exacerbating the economy's cyclicalities is the concentrated base of the state's revenue. 87% of Arizona's revenue comes from individual income taxes and the sales and use tax (State of Arizona, 2019). Because consumption and incomes are elastic to economic distress, the state is especially vulnerable to revenue declines during downturns. A study by Murphy and Bailey (2018) ranked Arizona as the fifth-most volatile state for state revenue collections, indicating that its concentrated revenue sources put it at a significant disadvantage for weathering economic storms. Further worsening cyclicalities is the concentration of consumption taxes on goods, rather than services. Currently, only around 33–40% of Arizona's sales tax revenue comes from services, and the rest is derived from goods (Wells and Goshert, 2018). Services are now exempt from new taxation due to a law passed in 2018 by Arizona voters, leaving the state to rely mostly on the sale of goods for future revenues.

However, as a proportion of total personal consumption expenditures, goods are declining, from just over 50% in the early 1930s to just over 30% in 2018. As a consequence, the portion of the Arizona economy covered by the sales tax has declined from 44% between 1998 through 2002 to 37% in 2018 (Wells and Goshert, 2018).

In order to become antifragile and experience lower cyclicalities, the state must broaden its industrial mix along with its revenue base. Investing in education and developing a knowledge economy will develop the workforce to attract and sustain high-technology jobs that will help Arizona to reposition itself to capitalize during economic disruptions. Additionally, the state should investigate possibilities for alternative revenue streams to diversify its current base. Specifically, Arizona should broaden its sales tax to include both in-person and digital services, broadening economic revenues and improving equity in the state's tax policy.

CONCLUSION: ARIZONA'S PATH TOWARDS ANTIFRAGILITY

An examination of Arizona's political attitudes, economic policies, and economic attributes inform **two key policy solutions for developing a knowledge economy**. The first is greater investment in education, including both the P20 system and workforce development; and in the state's infrastructure. A lack of funding is the cause of Arizona's fragility or resilience across many of the factors, and substantially increasing funding would move Arizona much closer towards antifragility. Secondly, the state should work to broaden its tax base, reduce centralized control and gubernatorial power over economic institutions, and reduce its reliance on cutting taxes and easing regulations to elicit economic growth.

In order to become antifragile and experience lower cyclicity, the state must broaden its industrial mix along with its revenue base. Investing in education and developing a knowledge economy will develop the workforce to attract and sustain high-technology jobs that will help Arizona to reposition itself to capitalize during economic disruptions.

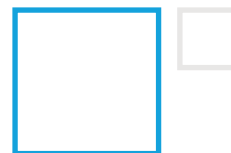


Table 4 provides a summary of the ratings that Arizona received for each factor along with the specific steps that it should take to become antifragile.

Arizona’s Position within the Antifragility Matrix | Table 4

	Fragile	Resilient	Antifragile
Political Attitudes			
Economic Development	Resilient	Focuses on industries, but sectors that have experienced gains primarily service population growth	Invest in human capital and expanding R&D
Risk	Resilient	Good BSF balance but 87% of revenue comes from two sources (income and sales taxes)	Broaden the state’s tax base
Technological and Economic Change	Resilient	Develops proactive strategies such as a large BSF fund yet does not aspire to create change	Enable emerging industries to develop through a highly-educated labor force
Public Resources	Resilient	Conserves resources by cutting taxes rather than investing revenues	Set specific goals and secure the resources necessary to accomplish them
Economic Policies			
Focus on economic policy	Fragile	Uses low corporate taxes and light regulation to drive growth through corporate relocations, tourism, and real estate development	Improve the conditions for the creation of industries that do not exist through greater investments in infrastructure and education
Management and Support of Economic Actors	Fragile	Underfunded civil service and education system under a centralized control	Improve education expenditures while restructuring the education policy system to reduce the centralization around gubernatorial power
Role of Tax Policy	Fragile	Lawmakers view tax policy as a singularly important tool, reducing taxes whenever revenues become available.	Develop a strategy to maximize the public’s economic return of investment instead of cutting taxes
Economic Attitudes			
Type of technology in economy	Resilient	Above-average increases in R&D spending	Invest in the research activities of public universities and support their patenting and entrepreneurship activities. ACA should attract businesses with large R&D expenditures
Labor Force/ Education Attainment	Fragile	Poor educational attainment and low-skill level of workforce	Invest significantly in the state’s P20 system
Business “Stickiness”	Resilient	Reliance on industries that are fueled by population growth	Create pools of highly skilled workers with industry-specific expertise
Connection to Other Regions and Markets	Fragile	Inward-looking economy with weak external connections	Develop a high-tech service economy while improving connections with regional economies
Cyclicality	Fragile	Industrial composition dependent upon population growth and a lack of diversity in the state’s revenue streams	Broadening of the state’s tax base and industrial mix

With the right policy interventions, Arizona can swiftly move from a fragile economy that relies on outmoded policies to an antifragile knowledge economy, empowering its populace to adapt and evolve to the changes that it encounters rather than be left behind as skills and jobs become obsolete. The development of new industries such as autonomous vehicles and growth in R&D spending show that Arizona is poised to quickly capitalize on targeted investments. Doing so will create a positive feedback loop, with high-skilled migration, industrial growth, trade, and capital flowing into the state to take advantage of the emergence of the knowledge economy. As this dynamic economic landscape develops, volatility will present opportunities for actors to collaborate and innovate, driving economic and technological progress forward into the future.



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References

- Altavena, L. (2019, March 19). The next big debate at the Arizona capitol: Is \$6.1B enough for K-12 schools? AZ Central. <https://www.azcentral.com/story/news/local/arizona-education/2019/03/18/arizona-nears-constitutionally-set-spending-limit-district-schools-funding-education/3203244002/>
- Andrew, E. (2019, June 26). Who were the Luddites. History.com. <https://www.history.com/new/who-were-the-luddites>
- Arizona Board of Regents. (2019). Fiscal year 2018 research report. https://www.azregents.edu/sites/default/files/reports/2018_Research_Report.pdf
- Arizona Commerce Authority. (n.d.). Streamlined regulation. <https://www.azcommerce.com/business-first/streamlined-regulation/>
- Arizona Commerce Authority. (2018). Five year plan. <https://www.azcommerce.com/media/1541864/aca-business-plan.pdf>
- Arizona Legislature. (2019, August 16). Budget stabilization fund history [data set]. <https://www.azleg.gov/jlbc/bsfhistory.pdf>
- Arizona Section of the American Society of Civil Engineers. (2020). Report card for Arizona infrastructure. https://infrastructurereportcard.org/wp-content/uploads/2020/09/FullReport-AZ2020-1_compressed.pdf
- Associated Press. (2010, December 20). A recent history of Arizona's state budget. <https://azcapitoltimes.com/news/2010/12/20/a-recent-history-of-arizonas-state-budget/>
- Augustyn, A., Critchfield, H., McNamee, G.L., Clark, E. (2019, December 12). Washington. Encyclopedia Britannica. <https://www.britannica.com/place/Washington-state>
- Bensinger, G. (2016, December 22). Uber moves self-driving car test to Arizona after regulatory defeat in California. Wall Street Journal. <https://www.wsj.com/articles/uber-moves-self-driving-car-test-to-arizona-after-regulatory-defeat-in-california-1482442732>
- Blair, P. (2016, January 11). Governor Doug Ducey: "We will lower taxes this year. Next year. And the year after." Americans for Tax Reform. <https://www.atr.org/governor-doug-ducey-we-will-lower-taxes-year-next-year-and-year-after>
- Blakemore, A., and Herrendorf, B. (2009). Economic growth: The importance of education and technological development. Arizona State University W.P. Carey School of Business. <https://repository.asu.edu/items/12482#embed>
- Brown, B. (2019, February 15). Paving the way: Maricopa County transportation funding on target, but missing statewide. Phoenix Business Journal. <https://www.bizjournals.com/phoenix/news/2019/02/15/paving-the-way-maricopa-county-transportation.html>
- Bureau of Economic Analysis. (2021). State annual personal income, 2020 (preliminary) and state quarterly personal income, 4th quarter 2020. https://www.bea.gov/sites/default/files/2021-03/spi0321_3.pdf
- Bureau of Economic Analysis. (2020). Real personal income by state and metropolitan area, 2019. https://www.bea.gov/sites/default/files/2020-12/rpp1220_0.pdf

- Bureau of Economic Analysis. (2019). State annual gross domestic product: Arizona [data set]. <https://apps.bea.gov/regional/downloadzip.cfm>
- Business Insights: Global. (2012, June 23). Weichert Relocation Resources Survey: Companies expect increase in corporate relocations. *Professional Services Close-Up*, 23.
- Dean Runyan Associates. (2019). Arizona travel impacts 2000-2018. Arizona Office of Tourism. <https://tourism.az.gov/wp-content/uploads/2019/07/Arizona-Travel-Impacts-2000-2018.pdf>
- Drenkard, S. (2017, February 10). Three big problem with sales taxes today — and how to fix them. Tax Foundation. <https://taxfoundation.org/three-big-problems-sales-tax/>
- Duda, J. (2019, May 15). No budget deal yet, but House Republicans say they're getting closer. *Arizona Mirror*. <https://www.azmirror.com/2019/05/15/no-budget-deal-yet-but-house-republicans-say-theyre-getting-closer/>.
- Elder, E. (2016). Weathering the next recession: How prepared are the 50 states? George Mason University Mercatus Center. <https://www.mercatus.org/publications/urban-economics/weathering-next-recession-how-prepared-are-50-states>
- Fischer, H. (2015, March 12). Ducey signs \$9.1B budget, will approve tax cuts. *East Valley Tribune*. https://www.eastvalleytribune.com/arizona/ducey-signs-b-budget-will-approve-tax-cuts/article_a9878dba-c98b-5b85-aec3-672116e4d85d.html
- Forstall, R. (1995). Arizona: Population of counties by decennial census: 1900 to 1990 [data set]. <https://www.census.gov/population/www/censusdata/cencounts/files/az190090.txt>
- Gleason, P. (2016, December 31). The 5 best and worst state tax changes of 2016, plus what's on the docket for 2017. *Forbes*. <https://www.forbes.com/sites/patrickgleason/2016/12/31/the-5-best-worst-state-tax-changes-of-2016-plus-whats-on-the-docket-for-2017/#2ac8a27b2314>
- Governor's Office of Strategic Planning and Budgeting. (2021, January 15). FY 2022 executive budget briefing. <https://www.azospb.gov/Documents/2021/FY%202022%20Executive%20Budget%20Rollout%20Presentation.pdf>
- Gross, D. (2010). Why Texas is doing so much better economically than the rest of the nation. *Slate*. <https://slate.com/business/2010/04/why-texas-is-doing-so-much-better-economically-than-the-rest-of-the-nation.html>
- Hansen, R., and Wiles, R. (2015, December 2). Arizona among the most damaged from downturn. *AZ Central*. <https://www.azcentral.com/story/money/business/economy/2015/12/02/arizona-among-most-damaged-downturn/76689516/>
- Hansen, R., and Wingett Sanchez, Y. (2016, November 2016). Tesla rival plans Casa Grande plant. *AZ Central*. <https://www.azcentral.com/story/money/business/economy/2016/11/29/electric-vehicle-company-plans-casa-grande-plant-lucid-motors/94610502/>
- Hill, K. (2006). Universities in the U.S. national innovation system. Arizona State University Productivity and Prosperity Project. <https://repository.asu.edu/items/12498#embed>

- Hill, K. (2017). The contribution of Arizona State University to the Arizona economy, fiscal year 2016. Arizona State University Center for Competitiveness and Prosperity Research. <https://repository.asu.edu/items/42161#embed>
- Hill, K., Hoffman, D., Rex, T. (2008). The economic contributions of the university system. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41886#embed>
- Hoffman, D. (2005). Jobs, income, and growth in Arizona: Individual versus aggregate measures of economic performance. Arizona State University Center for Competitiveness and Prosperity Research. <https://repository.asu.edu/items/12488#embed>
- Hoffman, D. (2006). Is resident undergraduate instruction at Arizona State University as nearly free as possible? Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41974>
- Hoffman, D., and Rex, T. (2008a). Preparing for an Arizona of 10 million people: Meeting the infrastructure challenges of growth. Arizona State University Center for Competitiveness and Prosperity Research. <https://repository.asu.edu/items/12458>
- Hoffman, D., and Rex, T. (2008b). Public finance in Arizona volume II: Concepts and issues. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/29101#embed>
- Hoffman, D., and Rex, T. (2008c). Tax reductions, the economy and the deficit in the Arizona state government general fund. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/42162>
- Hoffman, D., and Rex, T. (2009a). Education funding in Arizona: Constitutional requirement and the empirical record. Arizona State University Center for Competitiveness and Prosperity Research. <https://repository.asu.edu/items/29117>
- Hoffman, D., and Rex, T. (2009b). The economic effects of government spending reductions relative to other options. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41965>
- Hoffman, D., and Rex, T. (2010a). Arizona constitution: Specified duties of state government. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41887>
- Hoffman, D., and Rex, T. (2010b). Roadmap to Arizona's economic recovery: a package to create jobs, improve the state's economic competitiveness, and balance the budget. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/42159>
- Hoffman, D., and Rex, T. (2010c). The magnitude and causes of Arizona's low per capita income. Arizona State University Productivity and Prosperity Project. <http://wpcarey.asu.edu/sites/default/files/income2-10.pdf>
- Hoffman, D., and Rex, T. (2011). Creating jobs in Arizona by building and renovating physical infrastructure. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/29104#embed>
- Hoffman, D., and Rex, T. (2012a). An assessment of Arizona's economic competitiveness. Arizona State University Productivity and Prosperity Project. <http://wpcarey.asu.edu/sites/default/files/competitiveness5-12.pdf>

Hoffman, D., and Rex, T. (2012b). Benefits from improving educational attainment in Arizona. Arizona State University Productivity and Prosperity Project. <http://wpcarey.asu.edu/sites/default/files/edattainbenefits8-12.pdf>

Hoffman, D., and Rex, T. (2014). The impact of Arizona State University graduates employed in Arizona. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41972#embed>

Hoffman, D., and Rex, T. (2015a). Educational attainment by state and metropolitan area. Arizona State University Productivity and Prosperity Project. <https://wpcarey.asu.edu/sites/default/files/edattainstatemetro05-15.pdf>

Hoffman, D., and Rex, T. (2015b). Government revenues and expenditures in Arizona. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41968>

Hoffman, D., and Rex, T. (2016a). An economic comparison of Arizona and Nevada, with an emphasis on education. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/economyaznv2-16.pdf>

Hoffman, D., Rex, T. (2016b). The economic base of Arizona, Metropolitan Phoenix, Metropolitan Tucson, and the balance of the state: Updated with 2014 data. Arizona State University Productivity and Prosperity Project. <https://wpcarey.asu.edu/sites/default/files/basestudy07-16.pdf>

Hoffman, D., Rex, T. (2016c). The financing of public elementary and secondary education in Arizona. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/k12edfund07-16.pdf>

Hoffman, D., and Rex, T. (2016d). The financing of higher education in Arizona. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/higheredfund10-16.pdf>

Hoffman, D., and Rex, T. (2017). The financing of public education in Arizona: Update. Arizona State University Office of the University Economist. <https://repository.asu.edu/items/41968>

Hoffman, D., and Rex, T. (2018). Options for raising state government revenue in Arizona. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/revoptions01-18.pdf>

Hoffman, D., and Rex, T. (2020). Declines relative to the nation in Arizona's government finance, educational attainment, and economic performance. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/taxeducon01-20.pdf>

Hogan, T. (2011). An overview of the knowledge economy, with a focus on Arizona. Office of Arizona Productivity and Prosperity Project. <http://wpcarey.asu.edu/sites/default/files/knowledgeeconomy8-11.pdf>

Hogan, T. (2016). Arizona's income taxes: A comparison with other states and a policy discussion of potential tax reforms. Arizona State University Center for Competitive and Prosperity Research. <https://wpcarey.asu.edu/sites/default/files/incometax07-16.pdf>

Joint Legislative Budget Committee. (n.d.). Budget stabilization fund. <https://www.azleg.gov/jlbc/20baseline/520.pdf>

- Kang, C. (2017, November 11). Where self-driving cars go to learn. *New York Times*. <https://www.nytimes.com/2017/11/11/technology/arizona-tech-industry-favorite-self-driving-hub.html>
- Kelderman, K., Schaeffer, E., Pelton, T., Phillips, A., Bernhardt, C. (2019). The thin green line. The Environmental Integrity Project. <https://www.environmentalintegrity.org/wp-content/uploads/2019/12/The-Thin-Green-Line-report-12.5.19.pdf>
- Kwok, A. (2018, November 7). Prop. 126, the ban on service tax, passed convincingly. But will voters one day undo it? *AZ Central*. <https://www.azcentral.com/story/opinion/op-ed/abekwok/2018/11/07/arizona-service-tax-ban-prop-126-could-come-back-voters/1918909002/>
- Martis, K. C. & Clagg, S. E. (2019). West Virginia. *Encyclopedia Britannica*. <https://www.britannica.com/place/West-Virginia/Economy#ref78621>
- Murphy, M., Bailey, S. (2018). State revenue volatility and optimal reserve size are directly linked. *Pew Charitable Trusts*. <https://www.pewtrusts.org/en/research-and-analysis/articles/2018/11/14/state-revenue-volatility-and-optimal-reserve-size-are-directly-linked>
- National Education Association. (n.d.). Research on early childhood education. <http://www.nea.org/home/18226.htm>
- National Science Board. (2018). Science and engineering indicators: Arizona. *National Science Foundation*. <https://www.nsf.gov/nsb/sei/one-pagers/Arizona-2018.pdf>
- Office of Economic Opportunity. (2021, June 17). Monthly employment report. <https://www.azcommerce.com/oeo/>
- Office of Economic Opportunity. (2019, November 14). Monthly employment report. <https://laborstats.az.gov/sites/default/files/documents/files/emp-report.pdf>
- Office of the Governor. (2019, August 8). Secured: Arizona's rainy day fund bolstered to record 1 billion dollar balance. <https://azgovernor.gov/governor/news/2019/08/secured-arizonas-rainy-day-fund-bolstered-record-1-billion-dollar-balance>
- Oxford, A., and Polletta, M. (2019, October 30). As Arizona's population continues to grow, the state's government continues to shrink. *AZ Central*. <https://www.azcentral.com/story/news/politics/arizona/2019/10/30/arizona-civil-service-ranks-shrink-state-population-growth-doug-ducey-government/2487151001/>
- Pitzl, M. (2021, April 15). Arizona Supreme Court poised to hear challenge to Proposition 208, the education tax on higher earners. *AZ Central*. <https://www.azcentral.com/story/news/local/arizona-education/2021/04/15/prop-208-court-case-on-tax-to-boost-school-funding-to-be-heard-by-arizona-supreme-court/7213071002/>
- Pitzl, M. (2019, April 18). Lawmakers wanted state child-welfare agency to prevent abuse, neglect. Only 1.5% of its budget goes to that. *AZ Central*. <https://www.azcentral.com/story/news/local/arizona-child-welfare/2019/04/18/arizona-lawmakers-department-child-safety-prevent-abuse-neglect/3163758002/>
- Powell, W., and Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology*, 30, 199-220. doi: 10.1146/annurev.soc.29.010202.100037. https://scholar.harvard.edu/files/kaisa/files/powell_snellman.pdf

- Randazzo, R., Collom, L. (2019, March 19). Waymo plans big expansion of driverless car operations in Mesa. AZ Central. <https://www.azcentral.com/story/money/business/tech/2019/03/19/waymo-expand-arizona-big-mesa-facility-company-says/3202642002/>
- Rex, T. (2005a). Arizona job quality through 2003. Arizona State University Center for Competitiveness and Prosperity Research. <https://repository.asu.edu/items/12479#embed>
- Rex, T. (2005b). Higher education enrollment and finance in Arizona compared to all states. Arizona State University Productivity and Prosperity Project. <https://repository.asu.edu/items/12484#embed>
- Rex, T. (2014). Overview of economic competitiveness: Business and individual location factors, with a focus on Arizona. Arizona State University Center for Competitiveness and Prosperity Research. <https://wpcarey.asu.edu/sites/default/files/competitiveness11-14.pdf>
- Rex, T. (2016). Tax reductions in Arizona: Effects on economic growth and government revenue. Arizona State University Office of the University Economist. <https://wpcarey.asu.edu/sites/default/files/taxreductions10-16.pdf>
- Romero, S. (2018, December 31). Wielding rocks and knives, Arizonans attack self-driving cars. New York Times. <https://www.nytimes.com/2018/12/31/us/waymo-self-driving-cars-arizona-attacks.html>
- Secretary of state. (n.d.). Arizona's chronology. Retrieved December 10, 2019 from <https://azlibrary.gov/arizona-almanac/arizonas-chronology>
- Secretary of State. (2016, September 2). https://azlibrary.gov/sla/agency_histories/arizona-department-education-ade
- State of Arizona. (2019). Executive budget. <http://www.azospb.gov/Documents/2019/FY%202020%20Summary%20Book.pdf>
- Taleb, N.N. (2014). *Antifragile*. New York, NY: Random House.
- Texas Comptroller of Public Accounts. (n.d.). Texas net revenue by source for fiscal year 1978-2017. <https://comptroller.texas.gov/transparency/reports/revenue-by-source/history.php#2008>
- Thompson, D. (2010). How Texas is dominating the recession. *The Atlantic*. <https://www.theatlantic.com/business/archive/2010/07/how-texas-is-dominating-the-recession/60721/>
- U.S. Census Bureau. (2020). Educational attainment of the population 18 years and over, by age, sex, race, and Hispanic origin: 2020: All races [Data set]. <https://www.census.gov/data/tables/2020/demo/educational-attainment/cps-detailed-tables.html>
- U.S. Census Bureau. (2019a). Educational attainment of the population 18 years and over, by age, sex, race, and Hispanic origin: 2018: All races [Data set]. <https://www.census.gov/data/tables/2018/demo/education-attainment/cps-detailed-tables.html>

- U.S. Census Bureau. (2019b). Quick facts: United States; Arizona [data set]. <https://www.census.gov/quickfacts/fact/table/US,AZ/PST045219>
- U.S. Census Bureau. (2019c). State tax collections by state and type of tax 2019. <https://www.census.gov/data/tables/2019/econ/qtax/historical.html>
- U.S. Census Bureau. (2018). Quick facts: Arizona [data set]. <https://www.census.gov/quickfacts/AZ>
- U.S. Energy Information Administration. (2011, February 9). History of energy consumption in the United States 1775-2009. <https://www.eia.gov/todayinenergy/detail.php?id=10>
- Vanek, C. (2019, February 15). Paving the way: How transportation infrastructure drives Valley economic development. *Phoenix Business Journal*. <https://www.bizjournals.com/phoenix/news/2019/02/15/paving-the-way-how-transportation-infrastructure.html>
- Wells, D. (2018). State of the state budget 2018: The revenue system is broken. Grand Canyon Institute. <https://grandcanyoninstitute.org/state-of-the-state-budget-2018-the-revenue-system-is-broken/>
- Wells, D., and Goshert, M. (2018). Consequences of Prop. 126: \$250 million cut to education, future cuts to transportation funding and higher taxes on goods. Grand Canyon Institute. <https://grandcanyoninstitute.org/consequences-of-prop-126-250-million-cut-to-education-future-cuts-to-transportation-funding-and-higher-taxes-on-goods/>
- Wiles, R. (2018, December 28). Minimum wage in Arizona: 5 things to know. *AZCentral*. <https://www.azcentral.com/story/money/business/jobs/2018/12/28/arizona-minimum-wage-5-things-know/2425341002/>
- Wiles, R. (2019, May 21). U.S. Postal Service will test self-driving trucks in Arizona. *AZ Central*. <https://www.azcentral.com/story/money/business/2019/05/21/tusimple-run-self-driving-trucks-u-s-postal-service-arizona/3706357002/>
- Zambrano, L. (2021, April 16). Tourism taxing districts could be coming soon. *Arizona Capitol Times*. <https://azcapitoltimes.com/news/2021/04/16/tourism-taxing-districts-could-be-coming-soon/>

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This white paper was authored by product partners and is featured by the University Design Institute (UDI) to provoke thought and stimulate action around policy environments impacting higher education and knowledge economies globally. The target audience includes higher education decision-makers, policy advocates, investors/funders and other university thought-leaders.

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