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Hypotheses Testing for the Structural-Demographic Model for Political Instability and Social Unrest

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Abstract

Western societies are increasingly facing higher levels of political polarization and social unrest. Scholars seek to examine variables that may drive or predict political instability using comparative political theories that typically involve extensive use of inferential statistical methods. This paper explores a different path which shows the use of mathematical modelling to forecast the political unrest in Chile, the Latin American country. The model is based on the structural-demographic theory proposed by Goldstone (2017) and subsequently refined by P. Turchin and A. Korotayev (2020). In short, the main contribution of this paper is to apply and test other hypotheses that can explain the rise of political stress, such as dissatisfaction with austerity policies reminiscent of neoliberal orders followed by most Latin American countries, and/or the intense competition for surplus caused by rapid social mobility.

Keywords: *structural-demographic theory, political instability, Latin America, Chile.*

Introduction

Revolutionary waves of the 21st century are actively reshaping the World System that emerged in the aftermath of the fall of the Soviet Union. Broadly speaking, there is a compelling debate over how national tensions originate. Scholars believe that they might be related to the deterioration of the world economy and the rise of many inequalities that has led to the decline of living standards for many unqualified workers as well as outright conflicts between states which is closely related with the United States' diminished influence over other nations and foreign relations (Grinin and Grinin 2023; Goldstone, Grinin, and Korotayev 2022).

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From an epistemological perspective, academics who address political stability or instability typically focus on sociological or historical causes as their primary explanations. Through the identification of these patterns, they are able to establish correlations between different types of political events, often using statistical methods within the comparative politics framework. Furthermore, one of the challenges in working with explanatory models is that many of these variables interact dynamically with each other. Thus, it is necessary not only to understand the patterns of societal instability, but also to delve into the non-linear complexity of the problem itself.

In this article, we consider another way of analyzing political instability for a case study by modelling the predictive factors contributing to political unrest using a structural-demographic model in the context of Latin America. The main goal of this study is to test some hypotheses by manipulating specific variables contained in the mathematical model in order to see its effectiveness and accuracy in forecasting social unrest in Chile, a country that has experienced unprecedented waves of protest during 2019 (Gonzalez and Morán 2020; Olivos, Ayala, and Leyton 2022; Somma *et al.* 2020) leading to what scholars call a 'constitutional moment' (Ackerman 1993), a process that twice failed to bring about institutional changes desired by citizens.

Many authors have previously attempted to investigate political instability in Latin America by examining how political regime stability can correlate with micro and macroeconomic outcomes controlling for specific social characteristics such as cultural diversity and political factionalism that can predict levels of regime instability. Some suggest that the problem with Latin American regimes can be related mostly to their political structures; presidential regimes combined with low GDP per capita might actually weaken democracies throughout the region (Przeworski 2009). Others point out that the stability of democratic regimes might be more related with the openness of their economies and trade relations than controlling internal strife (Blanco and Grier 2008). More recent works refer to Latin American countries as 'hybrid states', in that they are weak in providing public goods, but are strong in violating citizens' human rights and are controlled by powerful elites (Mainwaring and Pérez-Liñán 2023).

Our case selection is based on various significant events that have recently shaken the core narratives of societal progress and economic development. Chile is a country that is no stranger to the concept of political instability. Its history of recent regime transition and democratic consolidation as well as economic prosperity has certainly made it an outlier compared to its neighbors. But this discourse is at odds with the harsh reality, that Chile is experiencing one of the biggest political crises since its regime change in the early 1990s. Over the

last three decades, Chile has seen mass mobilizations, general strikes, and hundreds of protests, that set the stage for the 2019–2020 Chilean Spring, one of the largest protests in Chilean history.

The authors and experts are convinced that the cause of this social outburst was, among other things, grievances associated with the neoliberal socio-economic order (Somma *et al.* 2020). If so, then this 'Chilean Spring' should be understood as just an expression of systemic anomalies. But, formally speaking, it is imperative to try to improve on structural reasons throughout modeling what is actually contributing to Chile's political instability, a matter which could be solved, for example, with the structural-demographic model.

Having identified the main objective of this paper, it is necessary to describe its reading sequence: the first section of this paper consists of a brief description of the model proposed by P. Turchin and A. Korotayev (2020), the second section presents the rationale for choosing the case study, including an overview of its recent political history and the potential structural factors that may be contributing to social unrest at both national and regional levels. The third section of this paper presents a detailed explanation of the selected variables, their sources, and the methods used for imputation to ensure a harmonized database. It is followed by a section of our modeling results and discussions that deals with a new hypothesis that could explain societal fractures for the Chilean context. At the end of the paper, there is a section of conclusions that exposes limits and virtues in applying the structural-demographic model for this specific case, and how manipulating some of its features could help to demonstrate different hypothesis regarding how political unrest builds up over time.

1. The Structural-Demographic Model

The structural-demographic model mostly acts as a parsimonious manifestation of the Structural-Demographic Theory (SDT), a holistic framework that has been developing over the years by a number of prominent authors in the field (Goldstone 2017; Korotayev *et al.* 2011; Ortmans *et al.* 2017; Turchin 2013, 2016; Turchin and Korotayev 2020). As this article aims only to apply SDT in addition to elucidation of some of its underlying theory and logic, it is advisable for readers who require a more detailed explanation of the model to refer to the cited works.

Going back on reviewing its main components, it is rather important to acknowledge that this model does not predict triggering events that could undermine social cohesion or political stability. Essentially, what the SDT provides is a model that encompasses long-term social pressures leading towards civil tensions in a more general sense, for instance, wide spread protests, riots,

strikes, civil wars, and other expressions of internal disharmony. In general, the SDT model pertains to a range of components that are intricately intertwined with political conflict. They are related to the population structure, the ruling class, and the state apparatus, each representing specific elements that are closely associated with political strife.

$$\Psi = MMP * EMP * SFD \quad \text{(Eq. 1)}$$

Having explained the main premises of the STD model, the main predicted variable the model outputs is called the Political Stress Indicator (PSI, or Ψ, see Eq. 1), which is modeled by the interaction of the Mass Mobilization Potential (MMP), the Elite Mobilization Potential (EMP), and a State Fiscal Distress (SFD) indicator. As implicitly stated above, these last three indexes match up with the central entities the SDT deals with: the population structure, the elites, and the state.

$$MMP = w^{-1} \frac{N_{urb}}{N} A_{20-29} \quad \text{(Eq. 2)}$$

MMP index is calculated with the inverse relative working-class wages w^{-1}, an urbanization index N_{urb}/N and the proportion of the 20–29 year population cohort. These components are embedded in the idea that the youth bulges are politically destabilizing because of increased education attainment, un-and-underemployment in urban contexts, and both job and elite positions that enhance intra-competition. Also, it goes without mentioning, those members belonging to this age cohort are particularly more susceptible to political radicalization and mobilization than their older more established counterparts (Goldstone 2017; Ortmans *et al.* 2017; Turchin 2013). Research has shown that, with minor variations on lag times and scale, political instability in Chile, and in other Latin American countries, were preceded by these specific demographic transitions (Zinkina and Andreev 2020).

$$EMP = \varepsilon^{-1} \frac{E}{sN} = \frac{1}{s} \varepsilon^{-1} e \quad \text{(Eq. 3)}$$

The next index represents the elite overproduction and competition, denoted as Elite Mobilization Potential or EMP, in which the first component ε^{-1} is analogous to the w^{-1}, representing the elite relative income scaled by GDP per capita. As it is powered by minus one, it should provide a measure of intra-elite competition in the economic domain. The second term represents the same but for the political sphere, especially in the arena of governmental affairs. If we assume that the demand for elite positions is proportional to the size of the elite class, E, then the supply of such government positions will only grow in proportion to the total population, N, which interacts with the constant number

of government employees, *s*, making it a hierarchical and highly competitive sphere.

When it comes to the dynamics of relative elite numbers, *e*, this is calculated with the following differential equation:

$$\frac{de}{dt} = \mu_0 \frac{w_0 - w}{w}, \quad \text{(Eq. 4)}$$

where w_0 and μ_0 serve as scaling parameters, helping to determine whether there are case-specific trends in upward or downward social mobility in societies (Turchin 2013). Parallel to the former calculation, relative income, ε, assumes that elites divide among themselves the amount of surplus produced by the economy. Dividing that amount by the numbers of elites, *E*, and scaling it by GDP per capita, ε would be obtained by the following:

$$\varepsilon = \frac{1 - w\lambda}{e} \quad \text{(Eq. 5)}$$

Once provided a simplified form, ε is therefore computed with the relative wages, *w*, the share of elites, *e*, relative to the entire population, λ, which represents the proportion of the entire labor force of a population at any given time.

The final component of the political distress equation is the State Fiscal Distress, which is established by the following :

$$SFD = \frac{Y}{G}(1 - T), \quad \text{(Eq. 6)}$$

where *Y* represents the national debt, *G* – Gross Domestic Product, and the second term is the degree of distrust in the government and its institutions, given that *T*, which means trust is being subtracted by 1, therefore, it actually indicates distrust, the other possible outcome from a probabilistic perspective.

By using this model Ortmans *et al.* (2017) and Turchin and Korotayev (2020) correctly forecasted for countries such as the United States and the United Kingdom the trends of political destabilization that will occur for the next decades for each country. Those increasing levels of instability are specifically arising from generalized immiseration, intra-elite conflict, state or government fragility regarding debt levels, and citizens' distrust. However, the same authors warn about some limitations of the SDT model itself, such as working within periods or *secular waves* or not taking into account external factors that can contribute or spill over into internal social unrest (*i.e.*, wars, revolutions, *etc.*).

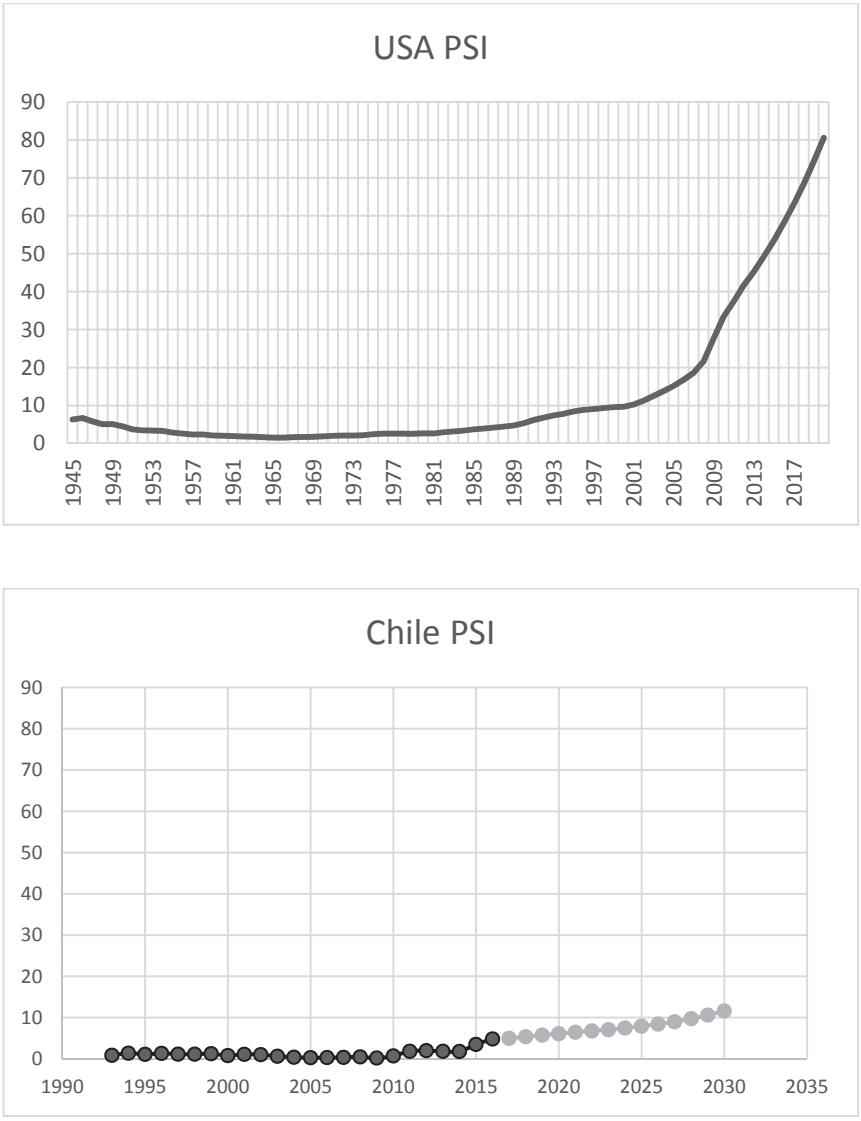


Fig. 1. PSI for the United States and Chile

Notes: The grey line represents the forecast results.

Source: Turchin and Korotayev (2020); and the author's database[1] for the Chilean case.

[1] Data upon request. E-mail: sebastianascuigac@ln.hk.

Preliminarily, it should be noted that the PSI model, based on SDT, exhibits only gradual and relatively modest growth in stress indicators for the selected case study, in contrast to the trend observed in the United States over the past three decades. The preliminary results obtained so far can be explained by two possible reasons: first, small changes in PSI are enough to cause instability in Chile, indicating a low level of social cohesion or institutional resilience. A possible second reason could be that the SDT model requires adjustment of some of its components in order to better represent the selected case study, which is something this paper intends to demonstrate.

It is also worth noting that Chile is a different country compared with the U.S. or U.K. political history. One commonality between many Latin American countries is their recent transition to democratic regimes. Another distinct characteristic is that Chile is facing a new era of reform and a number of political solutions that were designed to quell the widespread national protest and general strikes that marked the final trimester of 2019. Despite the attempts to win the popular vote, politicians advocating for substantial improvements to the political system ultimately failed to secure the necessary votes at the ballot box.

Returning to the model's results, one can state that adjusting some of the parameters of the model could improve the forecasting and predicting of sociopolitical tensions in the Chilean context. In order to achieve this, it would be reasonable for the readers to understand what causes instability in this particular context, and how this could be related to a more regional trend in Latin American politics.

2. Case Selection and Global Latin American Context

2.1. Sources of Political Strife in the 21st-Century Latin America

From the SDT perspective, Latin America as a region fosters conditions for citizens' dissatisfaction or overall distrust with the governmental institutions. For example, according to other studies, demographic changes had played a significant role in the onset of political instability in Chile and other Latin American countries during the last century (Zinkina and Andreev 2020). In addition, the region's history of high levels of inequality and corruption has also contributed to the problem.

Latin America is a highly unequal region in which most elites have remained intact even after most countries gained independence from their former colonial masters. But in the last decades of the 20th century, many of the same countries underwent neoliberal restructuring after failed industrialization attempts. This path was paved by the interventionism of the United States and its support of Latin American military regimes at that time. This neoliberal trend brought not only limited government when it came to economic decisions, but also restricted spaces for civil society alienating their influence from most policy decisions. As these policies were mostly delineated and devised by techno-

cratic groups, citizens began to criticize them and became increasingly dissatisfied with their institutions. From the citizens' perception, behind every euphemistic formality that often lead to austerity decisions, democratic institutions in the region are mostly tools for maintaining the privileged classes (Brown 2020).

Together, these conditions contributed to the recent emergency of right-wing populism in the region, especially in Chile, Brazil, Colombia, and currently in Argentina, fueled by discourses centered on corruption scandals, in which the established left-wing parties were deeply implicated (*Ibid.*). Demonstrating how ideological spectrum has significantly changed over these last few years, the right-wing factions that once feared left-wing uprisings started to gain ground among the general population and mobilize them against the traditional political establishments (Grinin and Grinin 2023).

2.2. Background of Chile's Political History

Chile's political history during the last decades of the 20th century was marked by different regime transitions. The 1973 coup d'état overthrew President Allende's Popular Unity government, and was followed by a brutal onslaught on their former political supporters of the previous administration and on the population itself. Only after 15 years of autocratic rule, a referendum was held in October, 1988 which decided whether the military regime would continue or whether the country should hold democratic elections, initiating a political transition to a more democratic type of regime instead of a military-power structure.

However, at the beginning of this newly founded democracy, incumbent politicians did not touch much of what had been done during the 17 years of the military dictatorship. During the previous regime, the Junta managed to adopt a new constitution for the country, later reformed by President Ricardo Lagos (2000–2006), and to set up a new private pension system, among other extremely liberalized public provisions.

In the years to come, protests, general strikes, mass mobilizations and many other forms of public demonstrations became a common theme for criticizing the legacy of those autocratic institutional arrangements. Interestingly enough, many of these were organized by secondary and postsecondary students. In a way, this democratic period can certainly be described as a challenging transition of power from militaristic appointees of the old regime to more civic and democratically orientated institutions but limited opportunities for public participation (Brown 2020).

2.3. Contextualizing Chile's Socioeconomic Issues and Social Unrest

Focusing on the issues that might explain the levels of social unrest in Chile in recent decades, many of these could be summarized as follows: recent

shocks of massive immigration waves, the cost of living crisis, and the cost of higher education. In addition to those problems, many recent cases of political corruption have contributed to massive citizens' disapproval of politicians as a whole, so institutional distrust has increased dramatically over the years (Gamboa and Segovia 2016).

Nevertheless, it was not until October 19, 2019 that public demonstrations of discontent reached a turning point for Chile's political institutions. These were the largest protests in the history of the country and were held because of the increase in public transport fares and police violence against the initial rioters (Somma *et al.* 2020), which paved the way for months of public demonstrations, violent protests, looting, and civil violence, resulting in the unfortunate loss of lives, thousands of people injured, and many companies going out of business.

After intense negotiation between political parties, the Chilean congress came up with a solution that would quell protestors and demonstrators all over the country called '*Acuerdo Por la Paz Social y Nueva Constitución*' (Agreement for Social Peace and New Constitution). Their plan was to call for the election of a group of representatives that would lead this new political process and draft a new constitution for the country that would be later ratified by its citizens in an upcoming referendum. Even though the Pinochet-Lagos Constitution fosters division among the Chilean population, the new proposal redacted by the Conventional Constitution was ultimately rejected on September of 2022 giving a landslide victory for the more centered-right politicians. After this, Chile's congress again launched the second editing process for the new constitution for 2023 with the promise for a more technocratic approach by introducing an Expert's Commission, a selected group of lawmakers exclusively nominated by congressmen and current members of the Senate. Once again this new proposal ended up being rejected in December 2023 by a 12-point margin and lower voter turnout.

Interestingly, all these events happened in a period of somewhat stable economic performance, and the more reason this tends to escape the understanding of many politicians and political commentators. In fairness, inside the South American region, Chile is somewhat of an economic miracle as some analysts like to frame it. Even in recent years of the economic deceleration, a trend that is often seen in developing countries, Chile has consistently shown steady growth rates explained mostly by its monetary stability and fiscal responsibility. All this makes it more counterintuitive for some pundits to understand or explain the current wave of massive social unrest.

A deeper look at what is happening at the economic level also reveals significant trends and changes. During the last three decades, the economy and state provisions have moved away from the traditional neoliberal logic imposed

during Pinochet's dictatorship towards a more mixed one mostly, by lessening its hyper-focused social security system with greater public spending and more generalized welfare programs. In addition, a number of reforms were gradually introduced, such as setting a minimum wage, expanding public health care with relatively good access and coverage, improving housing programmes, and setting new standards for public and private education. On the whole, the provision of public goods and services has generally increased. All of these have led undoubtedly to an improved general well-being of the Chilean population over the last 30 years.

The Chilean economy has repeatedly demonstrated financial stability under various administrations, and even with the vast reforms mentioned before, the country's risk historical indices suggest that it is inherently favorable for foreign investors. The same can be said in regard to sovereign risk ratings given by specialized agencies like S&P. Similarly, the 2022 referendum on a new constitution which led to a crushing defeat for more progressive and left-wing political parties and activists, might have even contributed to easing some of the economic uncertainties that many political and economic elites had over the draft proposal. Besides, the latest left-wing administration has also contributed to a favorable economic environment, by responsible fiscal tightening and increasing social spending in targeted areas such as healthcare and infrastructure. Foreign investment levels have maintained some stability in recent years even after the pandemic which had a stressing effect on public budgeting.

To sum up, the country is currently experiencing a double crisis: 1) high levels of political instability due to political unrest and, 2) the fiscal stress caused by the SARS-CoV-2 pandemic which has essentially created high levels of inflation. Although, it is worth noting that Chile has shown to the world that it has a privileged position for increasing debt ceilings through financial instruments such as sovereign bonds along with targeted expansionary fiscal policies.

However, a recurring theme about Chile's economic performance is that it seems to be overshadowed by its high levels of economic inequality. This is clearly illustrated by the historically high Gini coefficients, although it is fair to point out that economic inequality has been declining during the last decades in Chile according to official data. It is far from being low and still demonstrates a low deviation even when taken into account the fiscal intervention that makes for an accrued index (*i.e.,* after taxes and transfers).

Some authors believe that the ever-increasing political pressures in the country can be interpreted as a demand from citizens to increase state involvement and spending (Siavelis 2017; González-Bustamante 2019). Yet, politicians are seemingly more willing to push for more incremental measures or mean-tested policies, often citing the most common reasons, such as avoiding

high inflation rates and the need to repel populism in politics. But, again, those in the legislative or government branches tend to respond to public uprisings and massive protests. This is well illustrated by the student protests of 2011, spokespersons of the myriad of student movements that participated in those rallies tended to agree in criticizing the ulterior commercial motives of higher education institutions as well as denouncing the banking institutions involved in giving student loans. Continuous demonstrations proved to be an effective force for bottom-up democracy. Politicians in government and Congress were forced to implement more regulations and policies: lowering student loan interest rates, providing financial aid for those who lack the income, and more notoriously tuition-free college for the economically disadvantaged groups of society, although this policy was enacted during Michelle Bachelet's second administration from 2014–2018 and not during Sebastián Piñera's first administration from 2010–2014.

But even with those new policies working in favor of most working-class families, the problem with such educational reforms is that they are more focused on increasing the numbers of graduates than creating economic conditions for their optimum employment, like national fostering industries. Education policy assumes that tertiary education is a way to gain social mobility, but it can also lead to increased competition in many skilled job markets because of the increased supply of university and college graduates. Albeit, Chilean human capital has reached an all-time high record in the country's history, the mixed outcomes in terms of educational investment returns are not surprising (Rodríguez, Urzúa, and Reyes 2016; Hastings, Neilson, and Zimmerman 2013).

In a sense, many policymakers believe that Chile's extreme inequality can be tackled through tertiary education. A meritocratic belief that often collisions with Chilean elitism, that could be described as a form of restrictive networking that only provides the best economic opportunities for exclusive members of society by hindering, for example, job hiring for outsiders (Cárdenas and Hernández 2020; Undurraga 2019), showing an intense manifestation of segregation in terms of schooling among the privileged higher upper classes (Moya and Hernández 2017; Wai and Lincoln 2016), and, of course, demonstrating how advantageous job positions are reserved for the elite and their networks.

3. Method and Variables Choice: Applying the PSI Model

Having examined Chile's socioeconomic factors of instability, it is necessary to produce the structural demographic forecast proposed by Turchin and Korotayev (Turchin 2013, 2016; Turchin and Korotayev 2020). There are many public datasets available across several national and international institutions, but some specific variables require some processing to make their values better

fit the format used in the original model, especially those that need currency conversion from Chilean pesos to US dollars.

The modelling of the relative wage, or the term *w* in the equation, has to be drawn from various sources, so a step-by-step guide is necessary to point out all our procedures that were involved, firstly, to obtain the two main components to calculate the relative wage as close as possible to the variables presented in the cited paper (Officer and Williamson 2013). Relative wages data has to be yearly contextualized by processing the databases of the Earnings and Labor Cost Survey, an instrument that is carried out monthly by the National Institute of Statistics (NIS). The primary goal of this survey is to collect information from companies and other formal institutions about payrolls, worker's wages, hourly earnings, occupation, as well as some other series indicators. One of the challenges in working with this database is its time series, yet the amount of methodological changes it has undergone over the last decades makes its variables or estimates difficult to compare with each other, but fortunately there are techniques to solve these issues.

It is also worth noting that this survey can be summarized in four time-series data collections, the first of which contains observations from April 1993 to December 2005 with 1993 as its base index, the second one starts from January 2006 and ends in December 2009 with 2006 as its base, the third one starts in January 2009, it is based in that same year and ends in June 2017. Finally, there is the 2016 series which is also based that same year; this particular series continued to provide monthly information until more series are made publically available.

Based on these considerations, one should to calculate and convert the relative wages component of the model, the cost of unskilled labor, and the production worker hourly compensation into nominal US dollars. In order to calculate the cost of unskilled workers, the average wages of these workers are divided by their average working hours. While calculating the production worker hourly compensation, the same group of workers was chosen since the survey does not actually provide a clear distinction between unskilled labor and blue-collar workers. Although it contains one variable that classifies occupation according to ISCO 88 standard, nonetheless the displayed codes used in older versions of the surveys do not entirely match the aforementioned standard.

Afterward, each value representing the average production hourly compensation and the cost of unskilled labor was placed in the respective year. All series were given their own column because it is easier to create a single trend. And for each missing year observation, a simple splicing technique was performed which is also called the retropolation approach by some authors (Prados de la Escosura 2017). This mathematical method helps to connect every base year with the subsequent series: 1993, 2006, 2009, and 2016. Splicing methods

are widely used by national accountants because these methods help to fill in the missing values of one series with a time period that matches the values of another; in this case, the time period was represented by the variable 'Year', so the splicing method applied can be written as the following formula (see Eq. 7):

$$Y_t^R = \left(\frac{Y_T}{X_T} \right) \times X_t \text{, for } 0 \le t \le T \quad \text{(Eq. 7)}$$

This formula states that in order to create a new series (Y_t^R), one should accept a reference vector with its last benchmark series (Y_T), which is then re-scaled to an earlier or subsequent observation of the other series (X_T) with the ratio between the new and old series in the year (T), where both are overlapping (Y_T / X_T). Hence, the following formula can be used to estimate a consecutive or a previous observation:

$$Y_{t\pm1} = \left(Y_t / X_t \right) \times X_{t\pm1} \quad \text{(Eq. 8)}$$

From a mathematical perspective, this procedure is constructing one series out of many by treating the other base years as separated vectors inside our data matrix. To resemble the structural-demographic model proposed, we need to construct a solid trend with the oldest possible base index like the one presented in Officer and Williamson's data (2013).

Since not all series overlap, specifically, the one that starts in 1993 and ends in 2005 with the one that starts in 2006 and ends in 2009, there is a missing connecting value for the proposed splicing technique. To solve this issue, one value was interpolated by using a simple linear regression method for the year 2006's missing value. This method was also used to forecast other two response variables: the costs of unskilled labor and production workers' hourly compensation, borrowing Wubetie's (2017) specification, which is simplified as:

$$Y_{ij} = \beta_{0i} + \beta_{1ij} t_{ij} + \epsilon_{ij} \quad \text{(Eq. 9)}$$

The above states that i represents every value, and j stands for the time period interval of each series. In short, β_0 and β_1 are the intercept and slope parameters, and ϵ_{ij} is the error term, which is assumed to be normally distributed, that is, $\epsilon_i \sim N\left(\mu, \sigma^2\right)$. However, it should be noted that Wubetie (2017) cautions for the use of this method because it is known that not all socioeconomic variables may follow Gaussian distributions, a tendency that tends to force correlations and underestimate the standard errors of the coefficients as well the variance of the imputed values.

Therefore, there may arise the problems with the dataset consistency regarding the relative wage component of the model. The sampling method of the Earnings and Labor Cost Survey has changed considerably over the years, thus making it somewhat unfit for this kind of time series analysis. Even the National Institute of Statistics warns about the limitations in splicing different year-based series. Another problem related to the data consistency is in relying solely on unweighted survey data, which can be seen as dependent on biased estimators making it a source of critique from an econometric viewpoint. However, in defense of the procedures chosen for the analysis, it should be highlighted that it is not by any means trying to generate a set of consistent estimators or coefficients, its goal is to create multiple reliable trends for inclusion in the structural-demographic forecast model.

As mentioned above, the entirety of the processed Earnings and Labor Cost Survey's values had to undergo a currency conversion from Chilean pesos (CLP) to US dollars, by adjusting the currency value to the average nominal exchange rate for the observed period obtained from the Chilean Central Bank and the Chilean Internal Revenue Service websites. In addition, GDP per capita was taken from the World Bank's open data site, as was the urbanization index, while the A_{20-29} term was taken from the population projections of the National Institute of Statistics, and, at the same time, public debt scaled to GDP was taken from the Chilean Ministry of Finance.

Regarding the final variable, the survey data on trust in institutions was collected from the CEP Institution (Centro de Estudios Públicos, in Spanish), a non-profit foundation in Chile that provides information about local politics and public policy. The trust survey is usually conducted twice a year, so in order to harmonize the data it was decided to average the results for each year results.

To conclude this section, it is relevant to explain and expose every method and technique applied in constructing our database and closing gaps between years and specific observations. Despite many constraints regarding the data sources and collection methods there are enough to provide a consistent 20 to 30-year dataset that will prove to be useful for applying the structural-demographic model.

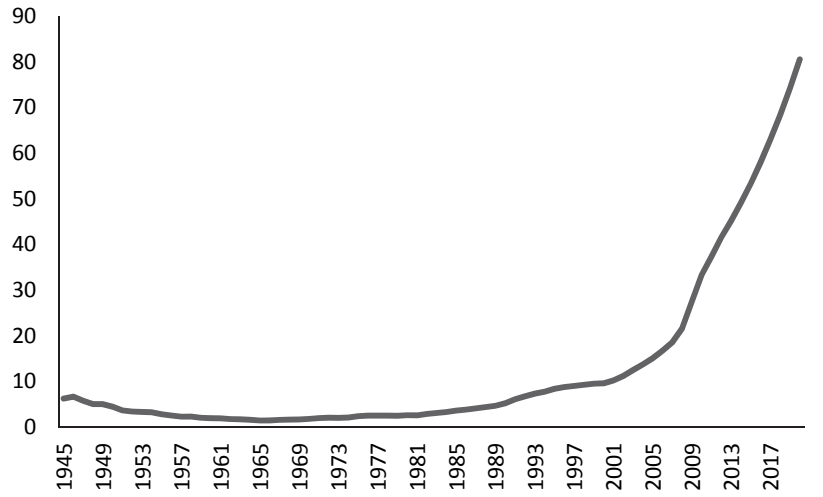
4. Results and Discussion

As can be seen in the first figures, the structural-demographic model shows rather poor results when forecasting Chile's political instability. Especially when compared to the US results, many variables seem to be weak predictors of political stress, such as institutional distrust and national debt, even if the relative wages indicator does display some degree of popular immiseration which should contribute to the mass mobilization potential.

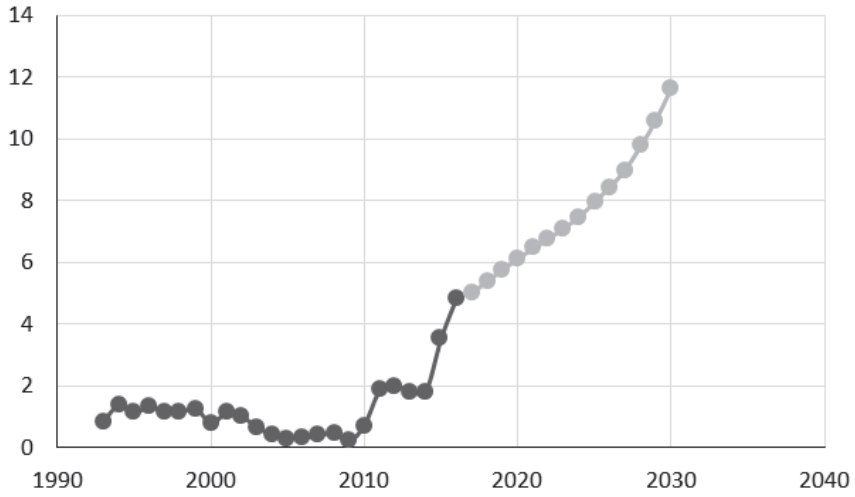
In fact, the data and the sources chosen definitely play a role in this result, but it is also worth mentioning whether there is any validity in the model itself. Due to its simplified form, there are many things the model cannot predict, as it was already stated above. The challenge is to connect Chilean political cycles of unrest and instability with what the model deduces from a given set of variables. Interestingly enough, manipulating some of them can help in creating a more reliable forecast that correctly summarizes the last three decades of Chilean democracy. But these procedures should be theoretically motivated, not just for modelling commitments alone.

Assuming that the SDT model requires distinct values to operate as inputs, this paper defines four new hypotheses to explore potential outcomes or model responses to changes. The first output (1) shows the level of political stress in the United States as a benchmark; the second output (2) assumes everything in the model is correct and slight changes in political stress (or Ψ) are enough for driving unrest in Chile. The third output (3) eliminates Real Debt from the equation, as the country debt levels show little variance so much over the years. The fourth output (4) explores the idea that Real Debt levels complementary probability, *i.e.* (1 – Real Debt) is what might be pushing stress levels in Chile, since it is expressing people's desire for more public spending. Finally, the fifth output (5) addresses the hypothesis that relates to the assessment of workers' wages relative to their response to social mobility expectations based on how much surplus in the economy is available for them.

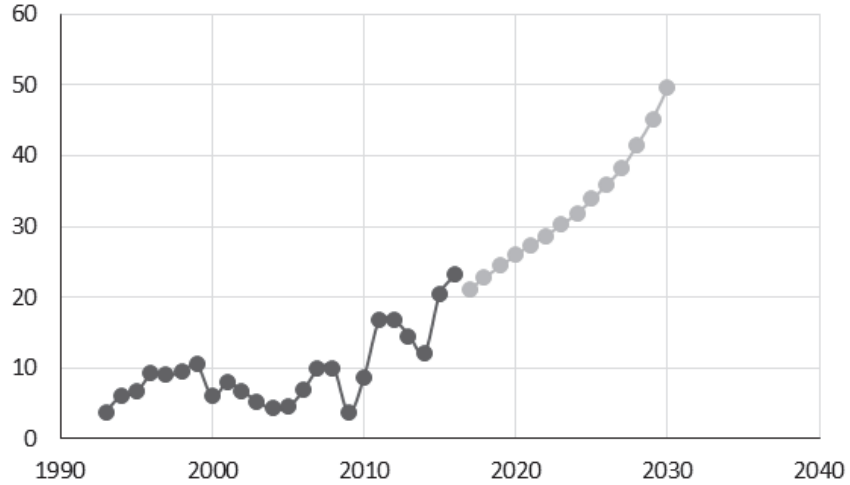
United States PSI (1)



Chile PSI without manipulation (2)



Without Real Debt (3)



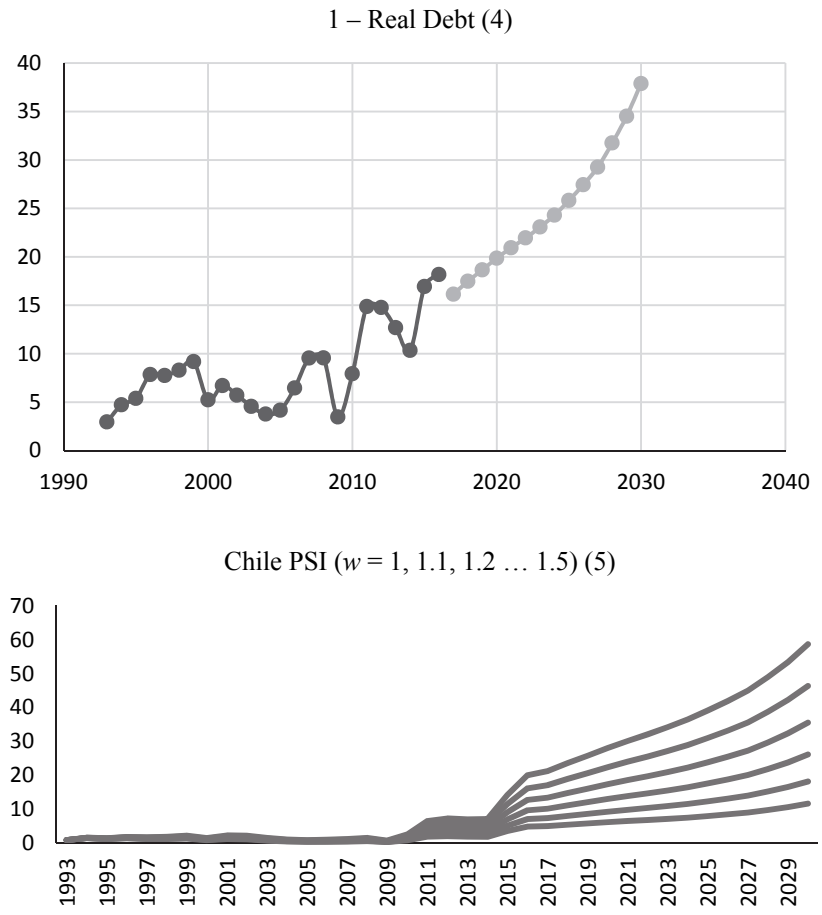


Fig. 2. Model Manipulation Results for Chile PSI

Notes: Grey lines represents the forecast values for 2, 3, and 4 graphs. For Graph 5, the forecast starts after year 2019.

Source: Data from the author's database[2].

One of the primary hypotheses deals with the National Debt variable by exploring two options on how to improve the accuracy of the prediction and forecast. Thus, by examining the results presented in Graphs 3 and 4, we can arrive at a practical explanation of the mechanism underlying the change in the variables. In short, the two main manipulations made in the structural-demo-

[2] Data upon request. E-mail: sebastianascuigac@ln.hk.

graphic model were based on: 1) accepting that public debt does not contribute to the state or fiscal distress index for this case, so it is better to eliminate it from the equation; or 2) another solution to recalculate it as a complementary outcome in probabilistic terms, which means (1 – *National Debt*).

Empirically speaking, the outcome was based on the reasonable assumption that government expenditure has little effect on the State Fiscal Distress Index, given that spending has not exceeded 37 % of Chilean GDP since 1991. But, it is also reasonable to assume that fiscal austerity might be fueling citizens' dissatisfaction with government or public institutions. The researchers who have analyzed distrust towards Chilean institutions note that, specifically, high levels of disaffection towards politics are generally observed in political parties and governmental institutions (Siavelis 2017). However, in part these findings have also been able to account for citizen consensus in favor of big government, that is, research has shown that Chileans are keen on calling for more public goods and services, and support introducing more regulations to the economy (*Ibid.*; González-Bustamante 2019).

Chile's annual budget is a tightly constrained process that involves different branches of the government and legislature, which is ultimately approved by Congress. This creates the need for ruling parties and opposing ones to intensify negotiations and possible adjustments. In a way, strict institutional control over public spending and debt can increase political instability or at least have a negative outcome in regard to political stress.

Going over the second hypothesis, on whether relative wages could have a considerable effect on increasing society stress, when elevating the aforementioned variable, w, to whatever value over 1, which is the standard value for the model, this drastically changes the outcome of the model that forecasts amassed stress levels for the second decade of this century. Thus, as an alternative for model manipulation, increasing the initial value of w makes sense, given that specialists have pointed out that social mobility in Chile is relatively fluid for most of the population (Torche 2005). Also, λ, or the proportion of the population in the labor force, cannot assume the standard value of .5, as population structure has shifted over the last 30 years into a more aging population and the real proportion should be near .4. Although testing these alterations provides similar output responses for the model.

5. Conclusion

The normal assumptions of the SDT do not seem to fit the case study, and while the variable selection can be perceived as problematic these are still proxy analogs of the standard model. By using specific approaches tackling these challenges, this study offers valuable insights into how adjusting a political stress model could work for a developing country like Chile.

One interesting outcome that is worth highlighting is that every displayed output shows small changes in PSI in 2006 and 2011, with a notorious – but relative – increase in the second decade of the 21st century. The aforementioned levels of political unrest correspond to the various cycles of protests that Chile has undergone in recent years, including the 2011 student uprisings, as well as the riots that occurred in 2019, making it clear that the STD model proves useful for representing intricate or even small secular cycles of state and social fragility that Chileans are still currently dealing with.

Pushing the boundaries of what is considered traditional thought in the structural-demographic theory shines light on other possible mechanisms that could explain social unrest in a rather stable economy in the region. By reviewing the case study, if National Debt can be rewritten into a different analytical category that appeals to the dissatisfaction with austerity or nullifies its existence altogether, and at the same time shows accurate depictions of Chilean political strife along with how surplus and relative wages are increasingly being contested by an ever-growing number of elite producers and/or stagnant levels of social mobility.

At present, there is an urgent need for research on political pressures that can lead to state meltdowns, making it a reliable field for models that can clarify the structural weakness of some societies. But also, applying these types of constructs for some can be misleading as to the particular nuances concerning idiosyncrasies of each society, because in the end, this paper can be perceived as reality fitting a model and not the other way around. Nonetheless, any form of manipulation and recalibration of a model should be conceptualized in a theoretical manner, rather than solely as a methodological aspect for fitting values which could end up contributing to self-fulfilling outputs and shallow results.

After all, there are many theories to explain what makes the region an unstable place for current politics. Explanations usually appeal to a generalized sentiment revolving over stagnant decline of inequalities and the overall dissatisfaction with their governments' institutions (see Goldstone, Grinin, and Korotayev 2022; González and Morán 2020; Mainwaring and Pérez-Liñán 2023). It is apparent that upcoming administrations in Latin America, with a specific focus on Chile, may adopt populist ideals (Brown 2020), especially to tackle new challenges such as organized crime. Unfortunately, it is highly unlikely that these governments address the root causes of the structural instabilities that may actually generate political unrest.

References

Ackerman B. 1993. *We the People: Foundations*. Harvard University Press.

Blanco L., and Grier R. 2008. Long Live Democracy: The Determinants of Political Instability in Latin America. *The Journal of Development Studies* 45(1): 76–95. https://doi.org/DOI: 10.1080/00220380802264788

Brown J. 2020. Neoliberalization, De-democratization, and Populist Responses in Western Europe, the US, and Latin America. *Critical Sociology* 46(7–8): 1173–1187. https://doi.org/10.1177/0896920520927456

Cárdenas C., and Hernández J. 2020. 'Hiring Someone Like Myself...'. Discourse and Discrimination in Recruitment and Selection Processes in Large Firms in Chile. *Discurso y Sociedad* 4(4): 790–822.

Gamboa R., and Segovia C. 2016. Chile 2015: Political Failure, Distrust and Reform. *Revista de Ciencia Política (Santiago)* 36(1): 123–144. https://dx.doi.org/10.4067/S0718-090X2016000100006

Goldstone J. A. 2017. Demographic Structural Theory: 25 Years On. *Cliodynamics* 8(2): 85–112. https://doi.org/10.21237/C7clio8237450

Goldstone J. A., Grinin L., and Korotayev A. 2022. Introduction. Changing Yet Persistent: Revolutions and Revolutionary Events. *New Waves of Revolutions in the 21st Century – Understanding the Causes and Effects of Disruptive Political Changes* / Ed. by J. Goldstone, L. Grinin, and A. Korotayev, pp. 1–34. Springer International Publishing. https://doi.org/10.1007/978-3-030-86468-2_1

Gonzalez R., and Morán C. L. F. 2020. The 2019–2020 Chilean Protests: A First Look at Their Causes and Participants. *International Journal of Sociology* 50(3): 227–235. https://doi.org/10.1080/00207659.2020.1752499

González-Bustamante B. 2019. Brechas, representación y congruencia élite-ciudadanía en Chile y Uruguay. *Convergencia* 26(80): 1–27. https://doi.org/10.29101/crcs.v26i80.11097

Grinin A., and Grinin L. 2023. The Twenty-First Century Revolutions as a Factor in the Reconfiguration of the World System. *Journal of Globalization Studies* 14(2): 3–26. https://doi.org/10.30884/jogs/2023.02.01

Hastings J., Neilson C., and Zimmerman S. 2013. Are Some Degrees Worth More than Others? Evidence from College Admission Cutoffs in Chile. *NBER Working Paper* No. W19241.

Korotayev A., Zinkina J., Kobzeva S., Bozhevolnov J., Malkov A., and Malkov S. 2011. A Trap at the Escape from the Trap? Demographic-Structural Factors of Political Instability in Modern Africa and West Asia. *Cliodynamics* 2(2): 276–303. https://doi.org/10.21237/C7clio22217

Mainwaring S., and Pérez-Liñán A. 2023. Why Latin America's Democracies are Stuck. *Journal of Democracy* 34(1): 156–170. https://doi.org/10.1353/jod.2023.0010

Moya E., and Hernández J. 2017. The Role of the Elite Schools in the Intergenerational Reproduction of the Chilean Elite. *Revista Austral De Ciencias Sociales* 26: 59–82. https://doi.org/10.4206/rev.austral.cienc.soc.2014.n26-04

Officer L., and Williamson S. 2013. *Annual Wages in the United States, 1774 – Present*. URL: http://www.measuringworth.com

Olivos F., Ayala C., and Leyton A. 2023. Pride and Protest: Horizontal and Vertical Emotional Response in the Aftermath of the 2019 Chilean Spring. *Sociological Perspectives* 66(4): 740–761. https://doi.org/10.1177/07311214221146595

Ortmans O., Mazzeo E., Meshcherina K., and Korotayev A. 2017. Modeling Social Pressures Toward Political Instability in the United Kingdom after 1960: A Demographic Structural Analysis. *Cliodynamics* 8(2): 113–150. https://doi.org/10.21237/C7clio8237313

Prados de la Escosura L. 2017. Splicing National Accounts, 1958–2015. *Spanish Economic Growth, 1850–2015 /* Ed. by K. G. Deng, pp. 169–187. https://doi.org/10.1007/978-3-319-58042-5_9

Przeworski A. 2009. The Mechanics of Regime Instability in Latin America. *Journal of Politics in Latin America* 1(1): 5–36.

Rodríguez J., Urzúa S., and Reyes L. 2016. Heterogeneous Economic Returns to Post-Secondary Degrees: Evidence from Chile. *The Journal of Human Resources* 51(2): 416–460.

Siavelis P. M. 2017. Elite–Mass Congruence in Chile. *Malaise in Representation in Latin American Countries: Chile, Argentina, and Uruguay* / Ed. by A. Joignant, M. Morales, and C. Fuentes, pp. 93–118. Palgrave McMillan.

Somma N., Bargsted B., Disi Pavlic R., and Medel R. M. 2020. No Water in the Oasis: The Chilean Spring of 2019–2020. *Social Movement Studies*. https://doi.org/10.1080/14742837.2020.1727737

Torche F. 2005. Unequal but Fluid: Social Mobility in Chile in Comparative Perspective. *American Sociological Review* 70(3): 422–450. https://doi.org/10.1177/000312240507000304

Turchin P. 2013. Modeling Social Pressures Toward Political Instability. *Cliodynamics* 4(2): 241–280. https://doi.org/10.21237/C7clio4221333

Turchin P. 2016. *Ages of Discord: A Structural-Demographic Analysis of American History*. Beresta Books LLC.

Turchin P., and Korotayev A. 2020. The 2010 Structural-Demographic Forecast for the 2010–2020 Decade: A Retrospective Assessment. *PLOS ONE* 15(8): 1–14. https://doi.org/10.1371/journal.pone.0237458

Undurraga R. 2019. Who Will Get the Job? Hiring Practices and Inequalities in the Chilean Labour Market. *Bulletin of Latin American Research* 38(5): 575–590. https://doi.org/10.1111/blar.12888

Wai J., and Lincoln D. 2016. Investigating the Right Tail of Wealth: Education, Cognitive Ability, Giving, Network Power, Gender, Ethnicity, Leadership, and Other Characteristics. *Intelligence* 54: 1–32.

Wubetie H. T. 2017. Missing Data Management and Statistical Measurement of Socio-Economic Status: Application of Big Data. *Journal of Big Data* 4(47). https://doi.org/10.1186/s40537-017-0099-y

Zinkina J., and Andreev A. 2020. The Demographic History and Current Age Structure in Latin America: The Youth Bulge and Implications for Sociopolitical Stability. *Journal of Globalization Studies* 11(2): 23–34. https://doi.org/ 10.30884/jogs/2020.02.02