

CHALLENGES IN CITIZENS' DIGITAL INTERACTION WITH THE STATE: A SCALE TO MEASURE ADMINISTRATIVE BURDEN

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In their interaction with the state, citizens often face challenges like eligibility forms, requirements, and senseless rules. These burdens can prevent access to public benefits, particularly for the poor, who are seen as undeserving and have little social or human capital. Some advocate for mobile apps and websites to ease access, but technology can also bring new challenges like high costs, privacy threats, and time/emotional tolls. This paper seeks to develop a new scale to measure administrative burdens for citizens applying for welfare benefits via digital interaction with the state. A sample of 413 respondents was used through Facebook groups dedicated to discussing the Brazilian Emergency Aid. Results showed evidence of reliability and validity for the burdens' scale, but limitations call for future research.

Keywords: administrative burdens, Emergency Aid, factor analysis, measurement invariance



DESAFIOS NA INTERAÇÃO DIGITAL DOS CIDADÃOS COM O ESTADO: UMA ESCALA PARA MEDIR OS OBSTÁCULOS ADMINISTRATIVOS

Em sua interação com o Estado, os cidadãos frequentemente enfrentam desafios como formulários de elegibilidade, requisitos e regras sem sentido. Esses obstáculos podem impedir o acesso aos benefícios públicos, particularmente para os pobres, que são vistos como desmerecedores e têm pouco capital social ou humano. Alguns argumentos defendem aplicativos e websites móveis para facilitar o acesso de determinados grupos sociais, mas a tecnologia também pode trazer novos desafios para eles como altos custos, ameaças à privacidade e custos de tempo/emocionais. Este artigo procura desenvolver uma nova escala para medir obstáculos administrativos para os cidadãos que se candidatam a benefícios sociais através da interação digital com o Estado. Uma amostra de 413 entrevistados foi utilizada através de grupos do Facebook dedicados a discutir o Auxílio Emergencial brasileiro. Os resultados mostraram uma escala com forte confiabilidade e validade, apesar de haver limitações que precisam ser endereçadas em pesquisas futuras.

Palavras-chave: obstáculos administrativos, Auxílio Emergencial, análise fatorial, *measurement invariance*

DESAFÍOS EN LA INTERACCIÓN DIGITAL DE LOS CIUDADANOS CON EL ESTADO: UNA ESCALA PARA MEDIR OBSTÁCULOS ADMINISTRATIVOS

En su interacción con el Estado, los ciudadanos a menudo enfrentan desafíos como formularios de elegibilidad, requisitos y reglas sin sentido. Estos obstáculos pueden dificultar el acceso a los beneficios públicos, especialmente para los pobres, quienes son percibidos como no merecedores y tienen poco capital social o humano. Algunos argumentos abogan por aplicaciones y sitios web móviles para facilitar el acceso de ciertos grupos sociales, pero la tecnología también puede presentarles nuevos desafíos, como costos elevados, amenazas a la privacidad y costos de tiempo/emocionales. Este artículo busca desarrollar una nueva escala para medir obstáculos administrativos para los ciudadanos que solicitan beneficios sociales a través de la interacción digital con el Estado. Se utilizó una muestra de 413 encuestados a través de grupos de Facebook dedicados a discutir el Auxilio Emergencial brasileño. Los resultados mostraron una escala con una fuerte confiabilidad y validez, aunque existen limitaciones que deben abordarse en investigaciones futuras.

Palabras clave: obstáculos administrativos, *Auxílio Emergencial*, análisis factorial, invarianza de medición

1. INTRODUCTION

The adoption of digital technologies has been pervasive in Public Administration (PA). They have been employed to address different services and processes, such as low-complexity tasks (Bullock et al., 2020), decision-making support (Alon-Barkat & Busuioc, 2021), and outputs prediction (Kleinberg et al., 2018). With this myriad of possibilities, they promise to build more streamlined public services to citizens while simultaneously providing more efficient and accountable processes for bureaucrats (Young et al., 2019). However, studies on the topic have been insufficiently developed, as information and communication technologies (ICT) and public policy algorithms are constantly evolving (Raisch & Krakowski, 2021).

Once technologies permeate a high number of processes and operations in a bureaucratic context, agencies become what Bovens and Zouridis (2002) call system-level bureaucracies. In this type of agency, algorithmic systems play a central role, affecting bureaucrats and citizens in countless ways. From an automation perspective, algorithms are used to curtail bureaucratic discretion and replace humans in many managerial tasks (Buffat, 2015; Raisch & Krakowski, 2021). Building on this analysis, literature suggests there is reduced administrative burdens, onerous relationships citizens experience in contact with the state (Peeters, 2020) through the standardization of bureaucratic behavior (Buffat, 2015).

Nevertheless, the relationships between the use of algorithms, bureaucrats, and administrative burdens may not be straightforward for many reasons. Since technology adoption can range from a web-based self-service tool (Herd et al., 2013) to pre-programmed tools that establish eligibility rules (Larsson, 2021), we need to measure the burdens present in citizen-state relationships and how they are reflected in system-level bureaucracies. For example, the introduction of algorithms can add new heuristics and biases to public decision-making (Alon-Barkat & Busuioc, 2021), create different roles, challenges, and demands for system-level bureaucrats (Castelluccia & Le Métayer, 2019; Zouridis et al., 2020), increase the potential of “grey zones” in policy implementation (Veale & Brass, 2019), as well as strengthen administrative costs (Peeters, 2020). In addition, burdens present in system-level bureaucracies may depend on how bureaucrats exercise discretion to employ or override algorithmic-based decisions (Alon-Barkat & Busuioc, 2021) and how the general public assesses outcomes of automated systems (Lee, 2018).

Due to mixed results regarding the use of technology to intermediate citizen-state interactions (Androutopoulou et al., 2019; Larsson, 2021), in this paper, we tried to propose a new measurement scale for burdens present in citizen-state interactions within system-level bureaucracies. To this aim, we conducted a survey among 413 Brazilian individuals that received the COVID-19 financial emergency aid and had to interact with a mobile app to claim the benefit. We based our analysis on the administrative burdens' literature (Herd & Moynihan, 2018) and studies about human-computer interactions (Binns, 2018; Srivastava et al., 2019), and

divided our study into five parts: i) a preliminary theoretical discussion about administrative burdens and the COVID financial aid; ii) an exploratory factor analysis (EFA) of a 36-items scale that stemmed from two previous validated scales that measured psychological burdens and other compliance and learning dimensions from CHI studies; iii) a series of confirmatory factor analysis (CFA) of our final seven-factors model with strong psychometric qualities; iv) a test for measurement invariance of our model; v) a final discussion and limitations of the study.

1.1 Administrative Burdens

In their interactions with the state, citizens must often deal with different burdens. Costs may emerge when people search for information about public services, need to comply with rules and requirements, and experience stresses or stigma from such relationships. There are several ways of minimizing these burdens, such as eliminating meaningless procedures or even trusting someone's word rather than requiring a document to prove it.

These costs are defined as administrative burdens. The concept is still debatable and has much been used interchangeably with red tape. Its boundaries still need some consensus, however, it entails common attributes: trivial or onerous costs derived from individual experiences through the relationship with government (Hattke, 2019; Herd & Moynihan, 2018; Peeters, 2020). According to Herd et al. (2013), it is distinct from rules as it takes citizen's experiences.

Research points out to three categories of administrative burden: learning, psychological and compliance costs. By disproportionately affecting disadvantaged social groups, learning costs, that is, the lack of knowledge, often alienate those who are eligible to public services by turning application processes more complex and obligating to search for the qualifications, the size of benefits and how to access for services (Herd & Moynihan, 2018).

Psychological costs are linked to the stigma that arises when participating in an unpopular program (Moynihan et al., 2015), exposure to sensitive personal information, and stress with the attendance in a government assistance policy or experience of disempowerment (Christensen et al., 2020). Disempowerment is associated with the sense of loss of autonomy provided by degrading, intrusive and directive experience in a relationship of power (Moynihan et al., 2015). A suitable image described by Moynihan et al. (2015, p. 49) can be applied to citizens pursuing welfare solutions in crisis contexts "when claimants feel they must artificially alter their identity to be successful, contorting themselves into what they perceive as the caseworker's image of the appropriate client".

Compliance costs are the material burdens of following rules and requirements (Herd & Moynihan, 2018). They are aspects of administrative burdens that relate to the processes of completing applications and reenrollments, providing documentation and avoiding or responding to discretionary demands (Herd et al., 2013). According to the authors, it has strong empirical evidence and the most extreme way to reduce this kind of burden is to auto

enroll eligible individuals in a program. For instance, in a study for temporary assistance to poor families, Brodtkin and Majmundar (2010) found that beneficiaries living in deep poverty are more likely to not overcome compliance costs experiencing some kind of administrative exclusion. Considering exclusion can happen in several contexts of citizen-state relationships, we may be underestimating the costs underserved individuals experience when they need to apply for public benefits through digital interfaces.

As studies describe it, the debate about administrative burdens is at a meeting point of two traditions – public administration (PA) and social policy (Herd & Moynihan, 2018; Moynihan et al., 2015). To the extent that rules are complicated and cumbersome, they restrict access to public services by disproportionately affecting powerless groups and those most in need of government benefits (Brodtkin & Majmundar, 2010; Heinrich, 2016). Moreover, administrative burdens do not happen randomly, but “are often designed into bureaucratic procedures or are unintended, but ultimately accepted, consequences of an organizational design or practice” (Peeters, 2020, p. 3).

Adopting Bovens and Zouridis' (2002) classification of agencies, the criteria of introduction of ICT in system-level bureaucracies can be used to understand onerous experiences with the state. For example, people may experience psychological costs because agencies may capture a massive collection of personal data for highly automated processes. This represents a threat to privacy and security, contributing to an increase of insecurity and stress (Acemoglu, 2021; Castelluccia & Le Métayer, 2019). Moreover, algorithmic decision systems have been increasingly connected to undesirable bias that result from training data and that can skew against certain groups of people (Gianfrancesco et al., 2018; Obermeyer et al., 2019). And finally, there may be a dehumanizing relationship with chatbots and through the decision-making of fully automated systems, which may finally lead to a disempowering ordeal (Binns, 2018; Carney, 2020; Yeung, 2019).

Adopting the framework of administrative burdens literature to understand digital barriers, we can clearly identify the dimensions present in citizens-state interactions. In terms of learning costs, it is not difficult to find people who struggle to set and remember different passwords to access governments portals, are forwarded to “broken links”, or need to search for complete information because search engines do not identify it (Michener, 2015). People may also find learning frustration in the available explanations about how algorithms work. As they can come with limited documentation and without any information on the code, people refer to them as “black boxes” impossible to decipher (Castelluccia & Le Métayer, 2019; Peeters & Widlak, 2018). Likewise, compliance costs can be found at complex website interfaces, limited number of characters and words in online entry fields, automatic refusal of applications, fewer opportunities for contestation, and so forth (Yeung, 2019). Psychological burdens in digital interactions are still present with stress, lack of autonomy, negative feelings and stigma that do not fade away with digital interface (Bozeman & Youtie, 2020).

1.2 The Brazilian Emergency Financial Aid: “o Auxílio Emergencial”

By now, we already know that administrative burdens are frictions that emerge from individuals' negative experience with governments' interactions (Madsen et al., 2021). Empirically, their impacts are mostly measured in terms of policy take up rates (Herd & Moynihan, 2018), but also appear through ethnographic inquiries on citizen's coping mechanisms (Masood & Nisar, 2021; Nisar, 2018), surveys that measure psychological costs in co-production (Thomsen et al., 2020), survey experiments that measure politicians' tolerance (Aarøe et al., 2021), deservingness of burdens (Baekgaard et al., 2021) and ideological beliefs that shape bureaucrats' perception of burdens (Bell et al., 2021).

These frictions can very much vary from one person to another; however, most researchers share the assumption that there are some groups that are more affected by burdens than others (Herd & Moynihan, 2018; Nisar, 2018). For example, they understand that the poor, the uneducated, women, immigrants, and other vulnerable minorities experience harsher rules than white, wealthy, and educated men (Eubanks, 2018; Herd & Moynihan, 2018). Literature on burdens has extensively explored cognitive and emotional aspects that affect how people negotiate administrative requirements (Christensen et al., 2020; Hattke et al., 2020). However, for each kind of interaction, authors adopt their own single measurement, lacking a consensual validated scale.

The coronavirus pandemic opened wide certain challenges to the state. During the quarantine, many governments granted to individuals in poor economic conditions a financial assistance (in Brazil, also known as “Auxílio Emergencial”) to go through the pandemic period without income. The temporary and emergency financial assistance provided by the state was created to help small business owners, housewives, informal workers, and unemployed taxpayers, and ranged from R\$ 600 (six hundred reais) to R\$ 1,200.00 (one thousand and two hundred reais) per month for five months, that is, during the economic shut down. These values were around 118 dollars and 237 dollars according to the exchange rate of December of 2020.

However, the identification of the target public and informal workers who were entitled to the Emergency Aid was a complex issue due to recent legislation that increased precariousness and turned some workers invisible to social protection policies (Cardoso, 2020). In this sense, the Federal Savings Bank (CEF) and the Social Security Information Technology Company (Dataprev) were responsible to operationalize the aid through a digital system labeled as *CaixaTem*, a mobile app used to register workers who were not beneficiaries of previous public policies but were financially affected by the pandemic.

In the country, more than 118 million people have been assisted with the Financial Aid, according to the Ministry of Development (Brasil, 2020). Although half of them could not be identified by their gender, the Ministry reported 37,8 million were women (55,43%) and 25.5% of the population was older than 25 years old and younger than 34 years old (Ministry

of Development, 2020). This population was defined according to the criteria the government adopted to grant the financial assistance at the time. Part of the beneficiaries were recipients of *Bolsa Família* (19,5 million people, or 28,55% of eligible people) or were pre-registered at *Cadastro Único* (10,5 million people, or 15,37% of eligible people), “an identification instrument and the socioeconomic characterization of Brazilian low-income families” (Cardoso, 2020, p. 1056). Also, it is important to note that eligible beneficiaries were unequally distributed across the cities, with São Paulo as the first city with more candidates (1,271), Rio de Janeiro as the second (941), Belo Horizonte the third (671) and so forth (Ministry of Development, 2020).

This database list was also complemented by people who reported income of less than R\$ 22,847.76 in 2019, the previous year of the pandemic, and could have applied for the benefit through the CEF mobile app *CaixaTem* (55,93% of eligible applicants). However, although some potential beneficiaries did not file income tax, could have been uninformed about the benefit, or have altruistic behavior (minimizing the probability of a needy person to have one's access to the benefit denied), we advocate that we were closer to the ideal setting to measure the burdens because the sample was defined by independent aspects that were not under applicants' control.

Our purpose of conducting the present research was twofold. First, we wanted to develop a new validated scale, based on two validated scales, to measure a more contextualized idea of digital administrative burdens. The first scale stemmed from human-interaction scholarship (CHI – computer-human interaction) and was used to measure the burdens experienced by users of different digital systems – User Burden Scale (UBS) (Suh et al., 2016). The other one was adopted to measure the burdens associated with psychological costs of coproducing public services (Thomsen et al., 2020). Second, while Thomsen et al. (2020) scale was used to test the potential downsides associated with citizen's coproduction, Suh's (2016) scale was developed aimed at users of computer systems in a general fashion. Indeed, none of the scales were used to measure administrative burdens jointly to apply for emergency aids.

The first validated scale has 12 items to measure psychological costs, which are related to individual experiences that result in stress, stigma, and loss of autonomy. These three latent concepts were used in an exploratory analysis by Thomsen et al. (2020) to measure psychological costs of citizen coproduction in an elderly care. The second validated scale has 24 items related to six dimensions (difficulty of use, physical, social and time, mental/cognitive and emotional, privacy, and financial) to measure the negative impacts computing systems might place on the user (Suh et al., 2016).

To establish a new way of measuring burdens from an individual perspective, we have brainstormed, developed, and adapted the items to compute the levels of stress, stigma, and autonomy when people needed to apply for the Emergency Aid, and the difficulty of use, the physical, time and social, mental/cognitive and emotional, privacy and financial burdens associated with the *CaixaTem* mobile app. To test this new adapted 36-items-scale, the order of

the items was randomized, and we forced participants to answer all the questions without the possibility to skip any question.

2. SAMPLE AND PROCEDURES

Our survey was designed on Qualtrics and was conducted through 36 existing Facebook groups dedicated to debate the requirements to have access to the financial emergency aid. To be able to take our survey, we have asked permission to moderators of these groups to post the survey invitation but only some of them allowed the post. To overcome the issue, we have also held a raffle of an online gift-card of R\$ 200,00 (two hundred reais) to promote participation on a Facebook page dedicated to researchers from the Brazilian School of Public and Business Administration (EBAPE). Facebook has been widely used to recruit large online convenience samples (Boas et al., 2020). Samuels and Zucco (2012) showed that Facebook is reasonable substitute for Mturk in countries where it does not work properly as a recruiting system. We targeted recruitment via advertisement to a particular demographic (i.e., over 18 years old) and interest group (i.e., “Caixa aplicativo celular”) on Facebook from December 2nd to 10th, 2021.

We expected 5-10 minutes to complete three sets of survey (UBS, Psychological costs, and Positive-Negative Affect Schedule – PNAS scale, from Watson et al. (1988)). Finding a weak relationship between the burdens and positive and negative affect would represent a good support for discriminant validity as well as an indication of uncorrelation with the error term and method bias (El Akremi et al., 2015; Podsakoff et al., 2012). In the end, we have got a non-probabilistic sample of 413 respondents, after cleaning the dataset from missing data, participants that did not agree to participate and people who did not apply for the emergency aid. Respondents agreed with each statement on a 1 (strongly disagree) to 5 (strongly agree) Likert-type scale. Their average age was 31.84 years (SD = 8.73), 89.10% were women, 42.13% were brown, 38.26% of São Paulo, 61.02% were single, 65.13% earn up to R\$ 1,000.00 per month, and 66.59% completed the high school.

3. EXPLORATORY FACTOR ANALYSIS (EFA)

To determine the factor structure of the 36-item scale, we randomly split the sample (N = 206), assumed normality of the indicators due to our sample size, and performed an exploratory factor analysis (EFA) using oblique rotation, which allows for correlated factors, and a minimum cutoff level of 0.50 for factor loadings (Tabachnick & Fidell, 2001). At this stage, we were not so strict to establish a high threshold, however, we removed 11 items for insufficient loadings on any factor. Among them, the 4-item measure for Autonomy was totally dropped because it did not load on any factor either. Therefore, they were all excluded from the final scale.

We then retained 25 indicators grouped into eight dimensions, however not all Cronbach's

alphas were greater than 0.70: 4 items for Time ($\alpha = 0.86$); 4 items for Cognitive and emotional ($\alpha = 0.82$); 4 items for Stigma ($\alpha = 0.83$); 3 items for Difficulty of use ($\alpha = 0.77$); 3 items for Financial costs ($\alpha = 0.70$); 3 items for Privacy ($\alpha = 0.66$); 2 items for Stress ($\alpha = 0.84$) and 2 items for an eighth factor, which we called Disempowerment, based on Christensen et al. (2020) and Thomsen et al. (2020) (“Eu tive medo de não ser aprovado ao solicitar o auxílio emergencial” and “É desagradável saber que outras pessoas não conseguiram receber o auxílio emergencial”) ($\alpha = 0.39$). According to George and Mallery (1998), the reliability coefficient lower than 0.50 is unacceptable, that is the case of disempowerment, which was equally dropped for this stage. Finally, high Cronbach' alphas indicate good reliability and precise measures, as we can see on the retained items of Table 1.

Table 1 - Exploratory Factor Analysis

	Factors and items	F1	F2	F3	F4	F5	F6	F7
Question F1: Time								
14	O aplicativo CaixaTem me fez gastar muito esforço mental. <i>The CaixaTem app made me expend a lot of mental effort.</i>	0,76						
20	Usar o aplicativo CaixaTem por muito tempo foi exaustivo. <i>Using the CaixaTem app for a long time was exhausting.</i>	0,75						
21	Eu gastei muito tempo usando o celular no aplicativo CaixaTem. <i>I spent a lot of time using my phone on the CaixaTem app.</i>	0,79						
26	Eu esperei muito tempo para ter uma resposta do benefício pelo aplicativo CaixaTem. <i>I waited a long time to receive a response about the benefit through the CaixaTem app.</i>	0,78						
F2: Cognitive and Emotional								
24	O uso do aplicativo CaixaTem me distraía de situações sociais. <i>Using the CaixaTem app distracted me from social situations.</i>		0,72					
27	O aplicativo CaixaTem me faz ter que memorizar um grande volume de informação. <i>The CaixaTem app requires me to memorize a large volume of information.</i>		0,70					
28	O aplicativo apresentava muitas informações ao mesmo tempo. <i>The app presented a lot of information all at once.</i>		0,72					
30	O aplicativo CaixaTem me forçou a mudar a forma como eu usava tecnologias digitais. <i>The CaixaTem app compelled me to change how I used digital technologies.</i>		0,76					

Factors and items		F1	F2	F3	F4	F5	F6	F7
F3: Stigma								
5	Eu tive medo de que outras pessoas me enxergassem com maus olhos por pedir o auxílio emergencial. <i>I was afraid that other people would see me in a negative way for requesting the emergency assistance.</i>			0,87				
7	Eu me senti desconfortável ao solicitar o auxílio emergencial. <i>I felt uncomfortable while applying for the emergency assistance.</i>			0,78				
8	Por ter solicitado o auxílio, acho que minha imagem diante de outras pessoas ficou prejudicada. <i>Because I applied for the aid, I believe my image in front of others was damaged.</i>			0,79				
29	Eu me sentia culpado(a) por solicitar o auxílio emergencial. <i>I felt guilty for requesting the emergency assistance.</i>			0,69				
F4: Difficulty of use								
13	Eu precisei de ajuda de outra pessoa para usar o aplicativo CaixaTem. <i>I needed help from someone else to use the CaixaTem app.</i>				0,71			
15	Foi difícil aprender a usar o aplicativo CaixaTem. <i>It was difficult to learn how to use the CaixaTem app.</i>				0,82			
17	Foi difícil compreender as orientações de uso do aplicativo CaixaTem. <i>It was difficult to understand the usage instructions of the CaixaTem app.</i>				0,79			
F5: Financial Cost								
34	Tive altos custos com aparelho celular e internet para usar o aplicativo CaixaTem. <i>I had high costs for the mobile device and internet to use the CaixaTem app.</i>					0,70		
35	Eu tive dificuldades financeiras para usar o aplicativo CaixaTem. <i>I had financial difficulties in using the CaixaTem app.</i>					0,64		
36	O uso do aplicativo CaixaTem não era gratuito para mim. <i>The use of the CaixaTem app wasn't free for me.</i>					0,87		
F6: Privacy								
31	Eu fiquei preocupado(a) com minhas informações pessoais que são compartilhadas pelo aplicativo CaixaTem. <i>I was concerned about my personal information being shared through the CaixaTem app.</i>						0,82	
32	As regras de privacidade do aplicativo CaixaTem não são confiáveis. <i>The privacy rules of the CaixaTem app are not trustworthy.</i>						0,64	
33	Eu tomei cuidado para proteger minha privacidade ao usar o aplicativo CaixaTem. <i>I took precautions to safeguard my privacy while using the CaixaTem app.</i>						0,71	

Factors and items		F1	F2	F3	F4	F5	F6	F7
F7: Stress								
1	Eu tive minha saúde física e mental afetada ao pedir o auxílio emergencial. <i>I had my physical and mental health affected when requesting the emergency assistance.</i>							0,75
2	Eu tive meu humor afetado negativamente ao pedir o auxílio emergencial. <i>My mood was negatively affected when requesting the emergency assistance.</i>							0,71
Eigen values		2,82	2,58	2,70	2,04	1,87	1,78	1,72
Cronbach's alpha		0,86	0,82	0,83	0,77	0,70	0,66	0,84

Note: Items are sorted by their loadings (>.5) on each factor. All the factor loadings are significant at $p < .05$.

Source: the author.

Also, we measured positive and negative affect (Watson et al., 1988) as an statistical remedy to common method bias (Podsakoff et al., 2012). Respondents indicated how they were feeling at that exact moment in a scale that ranged from 1 (totally disagree) to 5 (completely agree), and the Cronbach's alpha was 0.87. From Table 3 (PNAS), we noticed that we did not have any problem with common method variance.

Adopting a two-step procedure by analyzing the factor loadings (> 0.50) and Cronbach's alphas (> 0.60), from Table 1, and the summated scales correlation, from Table 2, we demonstrate our latent variable of digital administrative burdens have a good reliability. In turn, the summated scale approach is the most used technique to compute internal consistency and consists of the average of the items in the scale, creating a smaller set of variables. It provides a means of overcoming the measurement error, reducing the reliance on a single response, and has the ability to represent multiple aspects of a concept in a single measure (Fornell & Larcker, 1981).

Table 2 - Pairwise Correlation between the factors

	Mean	SD	1	2	3	4	5	6
1 Time	2,48	1,27						
2 Mental and emotional	2,13	1,09	0,57					
3 Stigma	1,88	1,04	0,36	0,36				
4 Difficulty of Use	2,15	1,19	0,48	0,47	0,21			
5 Financial costs	1,85	1,04	0,46	0,42	0,24	0,39		
6 Privacy	3,04	1,09	0,42	0,46	0,26	0,33	0,29	
7 Stress	2,16	1,25	0,45	0,44	0,46	0,32	0,34	0,31

Note: Number of observations = 206; SD = standard deviation.

Pairwise correlation: all coefficients are significant at $p < 0,05$

Source: the author.

From Table 2, we observe that the correlation coefficients of summated scales are strong (all above 0.21 for *Difficulty of use* and *Stigma*), suggesting they share a common cause. The correlation between Cognitive and emotional aspects and Time was the strongest one (= 0.57,

$p < 0.05$). However, to assess convergent and discriminant validity of our measures and assert they measure conceptually different constructs (in the CFA section), we adopted the Fornell and Larcker (1981) criteria that establishes that the squared correlation between the constructs should be smaller than the index, or the AVEs of all the indicators. The AVE, or the average variance extracted, provides the percentage of variation explained by the loadings, which should be greater than 0.50 for each burden dimension (El Akremi et al., 2015; Fornell & Larcker, 1981).

4. DISCUSSION ABOUT THE EFA

Although this first exploratory factor analysis showed support for most of the previous dimensions from both scales (7 out of 9), there were some replacements and drops due to insufficient factor loadings and low reliability of measures. Some previous dimensions lost items, as in the following: Autonomy lost 4 items (totally dropped); Time, 3 items; Physical, 2 items (totally dropped); Difficulty of use, 1 item; and Stress, 1 item. After the exclusion of these items, some indicators loaded on different factors, which we explain as follow.

Six indicators loaded on different factors if compared to the previous theoretical dimensions from both initial scales. However, I argue that some indicators overlap to measure burdens, such as Physical (i.e., “*Usar o aplicativo CaixaTem por muito tempo foi exaustivo.*”) and Time (“*Eu gastei muito tempo usando o celular no aplicativo CaixaTem.*”), and Cognitive and emotional (i.e., “*Eu me sentia culpado(a) por solicitar o auxílio emergencial.*”) and Stigma (i.e., “*Eu me senti desconfortável ao solicitar o auxílio emergencial.*”).

I tried to keep the initial dimensions presented in the first validated scales, however it was not possible after meaningful adjustments of items to capture the burdens associated with an emergency aid and the exploratory phase. In this sense, the new arrangement of the indicators was not totally exploratory, ending up with seven final dimensions: (i) Time, (ii) Cognitive and Emotional, (iii) Stigma, (iv) Difficulty of use, (v) Financial costs, (vi) Privacy, and (vii) Stress. They all showed high internal consistency, except for Privacy ($\alpha = 0.66$), which reported a questionable alpha.

It is important to note that high alphas do not solve the validity problem. The Cronbach's alpha represents just reliability of measure, not validity, and may be an indicative of oversimplification of the structure. According to DeVellis (2016), determining if a scale is reliable does not guarantee that the latent variable shared by the items is, in fact, the variable of interest. In other words, one might be measuring very precisely the wrong construct. In this sense, I made the decision to keep the indicators also based on additional criteria of validity.

5. FIRST-ORDER CONFIRMATORY FACTOR ANALYSIS (CFA)

In the other half randomly selected sample (N = 206), in which 91.75% were women, 41.26% have applied to receive the Emergency Aid through *CaixaTem*, the average age was 31.93 (SD= 8.53), 45.15% were brown, 67.48% finished high school, 38.35% were from São Paulo, 60.19% were single, and 62.62% earn less than R\$ 1,000.00 reais per month, I estimated a confirmatory factor analysis (CFA) model with seven reflective factors and 23 indicators: 4 for Time, 4 for Cognitive and emotional, 4 for Stigma, 3 for Difficulty of use, 3 for Financial costs, 3 for Privacy and 2 for Stress.

Table 3 - Test for convergent and discriminant validity evidence for the first-order model

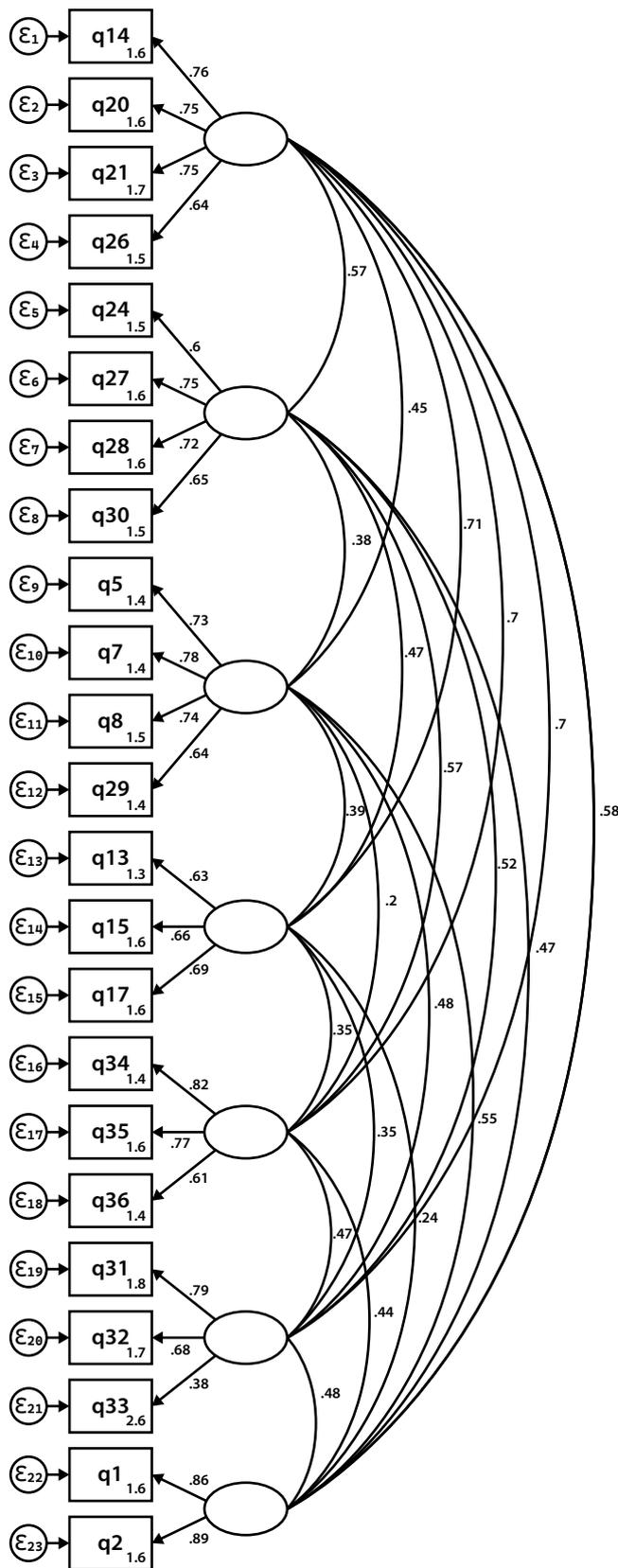
	1	2	3	4	5	6	7	Mean	SD	α	AVE	CR
1 Time	-							2,26	1,19	0,81	0,52	1,23
2 Cognitive and emotional	0,55 *	-						1,88	0,93	0,74	0,44	1,32
3 Stigma	0,37 *	0,33 *	-					1,77	1,01	0,81	0,52	1,23
4 Difficulty of Use	0,53 *	0,37 *	0,30 *	-				2,07	1,11	0,70	0,43	1,43
5 Financial costs	0,55 *	0,46 *	0,14	0,25 *	-			1,72	1,03	0,77	0,54	1,28
6 Privacy	0,48 *	0,35 *	0,30 *	0,22	0,33 *	-		2,86	1,06	0,64	0,41	1,52
7 Stress	0,50 *	0,39 *	0,54 *	0,19	0,37 *	0,31 *	-	2,01	1,26	0,87	0,77	1,15
8 PNAS	0,07	0,20	0,17	-0,02	-0,18	0,12	0,19	4,98	1,75	0,87	0,23	1,24

Note: SD: Standard Deviation; AVE: Average Variance extracted; CR: Composite reliability

Pairwise correlation: all coefficients are significant at $p < 0.05$.

Source: the author

Figure 1 – Measurement model for digital administrative burdens construct



Source: the author.

By using structural equation modelling (SEM), standardized estimates for factor loadings and the maximum likelihood estimation method (Mansur et al., 2017), I examined whether our seven-factor structure explained covariation among the scale items, each item loaded significantly on its correspondent factor, and each latent factor explained a sufficiently large proportion of variance of its measured indicators (El Akremi et al., 2015).

The results demonstrate reasonable support for the distinctiveness of the burdens' dimensions. However, some constructs did not reach the minimum of 50% of variance extracted (AVE), suggesting that some variance was not explained by the indicators in the case of *Cognitive and emotional* (0.44), *Difficulty of use* (0.43), and *Privacy* (0.41), which were all below 0.50. Despite these observations, overall, the AVE accounted for by the factor indicators was satisfactory, ranging from 0.41 to 0.77, with an average of 0.52. The reliability estimates (α) exceed recommended levels (above 0.70), except for *Privacy*, which reached 0.64. The covariance estimates among the seven dimensions of the burdens construct ranged from 0.20 to 0.71, with an average of 0.49 and lower than the average of the AVEs (Fornell & Larcker, 1981).

Table 4 - Confirmatory Factor Analysis Results

	χ^2 (df)	$\Delta\chi^2$ (df)	CFI	SRMR	RMSEA
Proposed seven-factor, first-order model	265.16 (209)	-	0,97	0,052	0,036
Alternative six-factor, first-order models					
Merging Time and Privacy burdens	310.93 (215)	45.77 (6)	0,95	0,055	0,047
Merging Time and Difficulty of Use burdens	325.99 (215)	60.83 (6)	0,94	0,060	0,050
Merging Time and Financial costs burdens	348.43 (215)	83.27 (6)	0,92	0,061	0,055
Alternative one-factor burden model	851.00 (230)	585.84 (21)	0,65	0,098	0,115

Notes: CFI: Confirmatory Factor Index; SRMR: standardized root mean squared residual; RMSEA: Root mean squared error of approximation

Source: the author.

My proposed seven-factor model of burdens fits the data well. The fit indexes are as follow: , $p = 0.005$, CFI = 0.97, RMSEA = 0.036, and SRMS = 0.052. The root mean squared error of approximation (RMSEA), the most important indicator to measure discrepancy, shows an expected result much lower than the acceptable 0.05, and the comparative fit index (CFI), which assesses the extent to which the tested model is superior to an alternative model in reproducing the observed covariance matrix (Chen, 2007), is 0.97, slightly above the minimum standard of 0.95. The SRMR (standardized root mean squared residual), which informs about how concentrated the data is around the best line of fit, is 0.052, evidence of a good fit with the data. Moreover, the single-factor model showed a significant worse fit: , $p < 0.001$, CFI = 0.65, RMSEA = 0.115, and SRMS = 0.098.

Also, to validate the seven constructs structural model, I conducted a series of CFAs to compare the chi-square differences between the models. I chose to merge the factors that showed the highest covariances (> 0.7) in the 7-factors measurement model. First, I merged *Time* and

Difficulty of use (covariance = 0.71). This six-factor model did not show better results than the seven-factors one: , $p < 0.001$, CFI = 0.94, RMSEA = 0.050, SRMR = 0.060. Second, I merged *Time* and *Financial* costs, which also showed high covariance (0.70), and the 6-factors model did not show better results than the seven-factor one: , $p < 0.001$, CFI = 0.92, RMSEA = 0.055, SRMR = 0.061. Then, I merged *Time* and *Privacy*, but this 6-factors model did not perform better than the 7-factors one either: , $p < 0.001$, CFI = 0.95, RMSEA = 0.047, SRMR = 0.055. Table 4 presents chi squares and fit parameters of the models.

6. MEASUREMENT INVARIANCE

To make group comparisons between the beneficiaries of the emergency aid that were previously enrolled at Bolsa Família and Cadastro Único with those that had to require the aid through *CaixaTem* mobile app, I tested the measurement invariance of the overall factor structure. Invariance, or measurement equivalence, concerns collecting subsamples and comparing CFA parameters between them (Pathki et al., 2021, p. 23). Based on my literature review, I argue that beneficiaries who had to apply for the aid using the *CaixaTem* mobile app are more likely to experience higher burdens than those who were pre-registered in cash transfer programs (CCT), such as *Bolsa Família* (BF) beneficiaries. So, I have grouped the responses in one dummy variable which I called Treatment, with 215 observations related with *Bolsa Família* and *Cadastro Único* beneficiaries and 198 related with *Caixa Tem*.

Although my sample (N=413) can be considered large, when testing measurement invariance of burdens among the *CaixaTem* and *BF/CadÚnico* groups using CFA, I could not proceed because Stata's maximization procedure failed to converge to a solution. In this regard, as I was unable to increase the sample size, I tried to overcome the issue by simplifying the model with only three latent variables, *Time*, *Cognitive* and *Stigma*, but it did not converge either. Then, I adopted a 2-factors model, only with *Time* and *Cognitive*.

Table 5 - Fit indexes for measurement invariance models

Model	Chi-square	df	RMSEA	CFI	SRMR
Configural (freely parameter estimates)	48,21	38	0,04	0,99	0,05
Metric (equal loadings)	54,84	44	0,04	0,99	0,05
Scalar (equal intercepts)	97,55	50	0,07	0,96	0,05
Strict (equal error variances)	110,84	58	0,07	0,96	0,05

Source: the author.

I first compared an equal form model, in which all parameters are freely estimated in both groups (configural), to a model with equality of loadings between groups (metric invariance model). Except for latent variables means, there were no constraints in the configural model. The results of the likelihood-ratio test did not show any significant difference: 6.62, $p = 0.36$. Secondly,

I set equal loadings and intercepts (scalar invariance model), but the comparison between the metric and scalar model showed significant variance ($\chi^2 = 42.71, p < 0.001$). I obtained invariance in the loadings (configural and metric models), which demonstrate small and non-significant changes in chi-squares. However, the same was not observed in the comparison between the metric and scalar invariance models, suggesting variance in the intercepts. Although the scalar model would be enough for combined group analyses, I chose to report the residual invariance level to make future suggestions for research below.

To the best of my knowledge, when sample sizes are adequate ($N > 300$) and are equal across groups, for testing loading invariance, a change of -0.010 in CFI, 0.015 in RMSEA or 0.030 in SRMR would indicate noninvariance (Chen, 2007). I observed there was a higher decrease (>0.01) in equal form and metric models' CFIs compared to scalar and strict ones (Table 5). However, advanced levels of variance and covariance invariance represent harder standards to fulfill in practice (Chen, 2007). One possible approach would be to increase the sample size and run the test again with the full model or be more flexible and allow the intercepts to be different across groups (partial invariance), so measurement models would be comparable by assigning weights to loadings/intercepts. Unfortunately, this approach would not be possible if lots of parameters are different.

7. DISCUSSION AND LIMITATIONS

Many authors claim that the automatic provision of social benefits can reduce administrative burdens for many cases (see Larsson, 2021), however, nonroutine cases that do not follow the same planned and designed patterns of interaction can certainly be more burdensome. With governments adopting the “digital-by-default” option for applying for benefits and other interactions, citizens can face increasing and different obstacles that were not present before. Complicated language, difficulties in identifying relevant authorities, and uncertainty to initiate the application procedure are among the difficulties entailed at digitalized interactions (Peeters, 2023).

Although usually perceived as a cost-effective solution, digitalization does not shift burdens from citizens to the state completely. In addition to diminishing the space for discretionary practices at the street-level that have traditionally met citizens' individual circumstances in an unequal context like the Brazilian, interactions in a digital environment require high cognitive skills, digital and administrative literacy, self-efficacy, perception of fairness in digital government, and material access to ICT, such as modern devices and Internet connection. Moreover, for citizens who struggle with lack of housing, basic sanitation, education, employment, health, and public safety, demanding new skills to navigate in virtual environments seems to increase citizens' burden and trigger new forms of exclusion. By being burdened with the task of having to use digital devices in this new “default option”, powerless citizens must assume an active role to be responsible themselves for their own means of access.

Requiring the financial emergency aid provides an interesting illustration with regards to the experiences of burdens, technological unevenness, and access: while many citizens received the aid improperly, many others, unemployed individuals, homeless people without assistance, single mothers, and elderly citizens, were prevented from receiving the benefit. It suggests that people are excluded and have their rights neglected every time a new system is implemented. Moreover, the more the relationships between society and the state are digitalized, the more different forms of exclusion are generated, affecting the poor, the elderly, and other categories of citizens more strongly than others.

The purposes of this study were to develop a new validated scale, based on two different but previously validated scales, to measure a more contextualized idea of digital administrative burdens and to establish a scale with strong psychometric qualities. Starting with 36 indicators, after the EFA, the scale ended up with 23 indicators across 7 factors, that were time, cognitive and emotional burdens, stigma, difficulty of use, financial costs, and stress. After splitting the 413 observations database in two random datasets (N=206) and conducting an exploratory factor analysis, the measurement model showed reliability with a good Cronbach's alpha and convergent and discriminant validity with significant factor loadings. The confirmatory analysis of the 7-factors model indicated a good fit of the data too. Overall, this scale has some importance for advancing understanding of how people in poverty manage burdens in the digital government.

I expected that beneficiaries who applied for the emergency aid through the mobile app would face higher burdens than those who were previously enrolled in CCTs programs. Although I observed that there was a significant difference in terms of stress for those who used the *Caixa Tem* app, other burdens' dimensions did not show significant differences between the groups. Therefore, measuring the multiple dimensions of administrative burdens to implement targeted interventions will not fully eliminate obstacles, but prevents widening the gap between those who have access and those who do not.

Regarding the study's limitations, I highlight the need for a larger sample to support a more complex model than the one adopted in the measurement invariance test. Because the sample was non-probabilistic, I could not infer generalization of the findings. To build a probabilistic sampling, in which each unit has a positive and known chance of being selected, one would need to design a sampling plan to define the frame more precisely.

For practitioners, it is important to keep in mind the digital divide that stratify citizens. To tackle the problem of digital exclusion, governments should consider under which conditions disadvantaged people are more likely to overcome digital exclusion, which dimensions of burdens they struggle more when interacting with the state, and to which services they are more likely to experience administrative burden. For example, it is possible that the stress for requiring the financial aid during the pandemic be higher than requiring the *Bolsa Família*

in a different moment. Also, besides building and investing in a technological infrastructure, governments should encourage individuals' autonomy, inspire creativity, subsidize digital literacy, and strengthen institutional structures.

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