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Free to Die: Economic Freedoms and Influenza Mortality

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Abstract

Seasonal influenzas are annually responsible for tens of thousands of deaths worldwide, often because of insufficient care which, in turn, may depend on orientations of economic policy. Yet, the empirical evidence on the relations that exist between policies based on different degrees of economic liberalism and flu mortality is still scarce. This paper contributes to filling the gap by proposing an empirical investigation into the effects of various dimensions of liberalism, proxied by the different components of the Fraser Index of Economic Freedom, on deaths from seasonal influenzas in a sample of 38 OECD countries observed from 1970 to 2018. A dynamic panel System-GMM estimator is used to alleviate endogeneity concerns. Findings show that: a) not every component of economic freedom has an effect on flu mortality; b) more economic freedom not always means less (or more) deaths from flu. In particular, stronger protection of property rights and lower government consumption are associated with higher flu mortality, which is instead lower when people and capital are freer to move. Such results give rise to policy considerations and contribute to inform policymakers about which actions can limit the mortality of a globally widespread disease like flu.

Keywords: Economic Freedom; Influenza mortality; OECD countries.

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1. Introduction

The Covid-19 pandemic has unveiled several weaknesses of the healthcare systems of developed and developing economies (Freed et al., 2020). Until May 2022 SARS-CoV-2 has infected more than 520 million people around the world, causing nearly 6.2 million reported deaths (WHO, 2021). While media worldwide have being paying much attention to Covid-19, this is not the only pandemic causing thousands of deaths. Thoughts may then go back to those caused by H1N1 virus at the end of the First World War (the so-called *Spanish flu*), whose characteristics were not totally dissimilar from those of SARS-CoV-2 (He et al., 2020). Nevertheless, seasonal influenzas, which affect the globe every year, are annually responsible for tens of thousands of deaths in both developed and developing countries, often because of insufficient care (e.g. Simonsen, 1999; Cox et al., 2003; Iuliano et al., 2018; Paget et al., 2019; Cozza et al., 2021).

Governments fund the healthcare system in all the major world economies (OECD, 2021), though big differences between countries exist. In some (e.g. Italy and France), public expenditure covers most of the costs of the system, which is mainly public; in others (e.g. the U.S.A.), public coverage is limited to some essential services, and most of the system is private. These approaches mirror the different orientations of economic policy that characterise countries worldwide. Western economies have adopted different models of capitalism (Coates, 2005), which have led to contrasting approaches to public spending and healthcare provision and, more generally, to various degrees of government interference in the economy. Indeed, a major difference between the existent varieties of capitalism is the degree of liberalism adopted by the different governments (Becker, 2009). More specifically, after the Second World War, and particularly with the emergence of the *Washington Consensus* (Babb, 2013), more liberal approaches have characterised several countries in the world, thus affecting policies in the domain of both public expenditure and health systems; this especially occurred where the international economic institutions intervened to support transitions and development between 1980 and the early 2000s.

The extant literature highlights that different health systems may respond differently to the threat of annual influenza epidemics (Fedson, 2009; Briand et al., 2011) with diverging health consequences for the populations. Part of these differences depends on how many people can access national healthcare systems. For instance, Di Novi and Migheli (2017) and Dickman et al.

(2017) recall that a large share of the U.S. population has no access to the most of health services, because they are unaffordable for low-income people. Northon et al. (2002) Buchmueller et al. (2004) have shown that the demand for and actual access to healthcare services depend on their price which can discourage people from accessing, so putting their health at risk. Liberal approaches, moreover, not only affects health outcomes via public expenditure and healthcare costs, but also through many other channels. Other domains of economic liberalism may be positively or negatively related to health. The protection of property rights, the promotion of individual initiative, and well-functioning market mechanisms, for instance, may foster the development of drugs and vaccines (Roberts and Olson, 2013). Similarly, the possibility of trading internationally may facilitate the imports of hospital equipment and drugs and knowledge spillovers in the field of health (Stevens et al., 2013). Moreover, labour market deregulation may increase (decrease) unemployment (Baccaro and Rei, 2007) and, consequently, strengthen (weaken) people's capacity to afford healthcare (Piton and Rycx, 2019). In parallel, the free circulation of people between and within countries and the frequency of such movements may increase the circulation of pathogens.

The extant literature, however, mainly focused on the relationship between the size of public health expenditure and people's health (among others, Basu et al., 2012; Dickman et al., 2017; Di Novi and Migheli, 2017; Callison and Sicilian, 2018), while few works empirically investigated how this latter can be more generally affected also by other domains of economic liberalism (Stroup, 2007; McCartney et al., 2012; Razvi and Chakraborty, 2016; Hall et al., 2018a; Sharma, 2020; de Soysa and Vadlamannati, 2021a). Moreover, only a few studies explored the relationship between economic liberalism and the capacity to mitigate the prevalence and effects of specific common diseases (Dayaratna et al., 2020; Hoekman et al., 2020; Geloso et al., 2021), although this issue is particularly relevant to identify policies to limit their adverse consequences globally. When it was done, the analysis was mainly descriptive (Dayaratna et al., 2020; Hoekman et al., 2020) and/or limited to specific historical or geographical case-studies (Hoekman et al., 2020; Geloso et al., 2021), while the multifaceted nature of economic liberalism was never considered. To the best of our knowledge, indeed, no effort was made to estimate the relations that exist between the various domains of liberalism and the health effects of a common contemporary disease in a substantial sample of countries.

This paper contributes to filling the gap by proposing an empirical investigation into the effects of various dimensions of economic liberalism on deaths from seasonal influenzas in a sample of 38 OECD countries observed between 1970 and 2018. The analysis uses a dynamic panel generalized method of moments (GMM) estimator to alleviate endogeneity concerns. Regarding the measurement of economic liberalism, the simplest available proxy for public intervention in the field of interest is the government per capita expenditure on healthcare. However, the OECD (2021) shows that the country with the highest value of this variable is the U.S.A., where the healthcare system is mostly private and not affordable for a large share of the population. Moreover, as already noticed, liberalism can affect health through many channels other than public expenditure. Therefore, alternative measures of liberalism in governing economies in general, and healthcare systems in particular, seem more appropriate. The extant literature proposes indices of economic freedom (Gwartney and Lawson, 2003; Gwartney et al., 2021), which appear helpful for our purpose as they provide a general measurement of how much liberal an economy is, considering different aspects of liberalism, such as protection of property rights, monetary governance, the freedom to trade internationally, the size of government (also including public consumption) and regulation. Therefore, in this paper liberalism is identified with economic freedom as defined by the Fraser Institute and its Economic Freedom Report, i.e., "how closely the institutions and policies of a country correspond with the classical liberal ideal of a limited government, where the government protects property rights and arranges for the provision of a limited set of "public goods" such as national defence and access to money of sound value, but little beyond these core functions" (Gwartney et al., 2021, p. 2).

2. Related literature

Seasonal influenza is a yearly characteristic of the world. While this disease is generally considered as a minor illness, Cozza et al. (2021) show that it results in thousands of deaths every year: their average estimates amount to a total of 409,111 casualties worldwide between 1980 and 2016. The authors highlight that the patients with other pathologies, with immunodeficiency and very young or very old may develop respiratory and other collateral problems, which lead them to death. For example, in the United States, during the peak week of winter influenza between 2013 and 2020, an average of 752 people died each year, and others

did during the rest of the epidemic (Faust and Del Rio, 2020). In 2008 (Nair et al., 2011) and 2018 (Wang et al., 2020) influenza killed more than 50,000 children aged 5 or less worldwide because the virus affected their lower respiratory tract (Wang et al., 2020) or worsened the effects of cardiovascular pathologies (Nguyen et al., 2016). Iuliano et al. (2018) show that the highest number of influenza-related casualties per 100,000 people occurs in sub-Saharan Africa and Southeast Asia, the two areas where access to healthcare is more limited than in the rest of the world. In addition, Palache et al. (2014) highlight that also the distribution of vaccinated people is highly unequal in the world; they find that the absence of public funded policies (e.g. reimbursement or free provision of the vaccine and healthcare provision) is the most relevant reason explaining the observed disparities. The conclusions of the two last articles suggest that public spending in healthcare may mitigate the negative effects of influenza, also reducing – at least potentially – the number of deaths. Basu et al. (2012) provide further support to this claim, as they show that, in low- and middle-income countries, private healthcare facilities are less effective in curing patients because of the lack of equipment and trained personnel. In parallel, the extant literature provides evidence that liberal economies and liberal reforms are prone to limit public funds for healthcare systems (e.g. Qadeer and Chakravarthi, 2010; Baum et al., 2016).

In the light of the results summarised above, the analysis of the relationship of economic liberalism with healthcare access and effectiveness is relevant to understanding – at least partially – why the same disease (e.g. seasonal influenza) features different mortality rates not only between advanced and developing economies, but also between the countries within each group. As mentioned in the previous section, the measurement of economic liberalism is not an easy task and many different aspects may be included in or excluded from such concept (Katznelson, 2021). Nevertheless, economists have tried to create measures of liberalism. Indices of economic freedom are one of the most common ways to assess the level of liberalism of an economy (Hall and Lawson, 2014; Ott, 2018; Lawson et al., 2020) and evidence exists that economic freedom affects social development, including people's health and healthcare provision (Medina-Moral and Montes-Gan, 2018). However, the literature on this issue provides inconclusive results. According to some studies, higher levels of economic freedom (often measured through the index calculated by the Fraser Institute) are associated, on average, with better health conditions. In a large sample of both developed and developing economies, Stroup (2007) shows that freer countries are characterised by a longer life expectancy and a lower child

mortality. Analogously, Razvi and Chakraborty (2016) show that more economic freedom results in lower infant mortality in the federated states of India; however, the authors claim that coordination between public and private health authorities is necessary to reach such a goal. Sharma (2020) analyses economic freedom and life expectancy in sub-Saharan Africa, showing that all the aspects of economic freedom, but a lower public expenditure, positively affect life expectancy (taken as a measure of average health). Considering 149 countries between 1970 and 2015, de Soysa and Vadlamannati (2021a) show that, as economic freedom increases, within-country health inequality declines.

Some works, however, find opposite results. Economic freedom has proved to have no or negative effects on Scottish people's health (McCartney et al., 2012). Callison and Sicilian (2018) show that the increase in public expenditure on healthcare in the U.S.A. after introducing the Affordable Care Act has improved workers' health conditions and their labour market outcomes. Always considering the United States, Hall et al. (2018a) find that health is worse in economically freer states. More recently, mixed evidence has emerged comparing the effects of economic freedom on two different pathologies that affected the U.S.A. during the nineteenth century and the beginning of the twentieth: smallpox and typhus. Geloso et al. (2021) show that, while economic freedom is associated with fewer deaths due to typhus, no effect is detectable in relationship with smallpox. Finally, it is noteworthy that economic freedom is often found to be associated with higher income inequality (de Soysa and Vadlamannati, 2021b), which may lead to more limited access to healthcare for the poor in countries where its provision is mainly private (e.g. Schoen, 2000; Zhao, 2006).

In addition, the literature highlights the existence of a negative relationship between economic freedom and some specific health outcomes in developed countries: for instance, Lawson et al. (2016) show that as economic freedom increases in advanced economies, so does the body mass index of men, meaning that liberalism seems to ease obesity. Consistently, Hall et al. (2018b) show that, in the U.S.A., people living in economically freer states practice physical exercise less, which may lead to worse health conditions. However, also in this case, the evidence provided by the literature is mixed: Ruseski and Maresova (2014) find the opposite result, studying the relationship existing between economic freedom and sports activities in a sample of countries.

The literature on economic freedom and pandemics shows the existence of some relationships between the two. In fact, as the first increases, economies are more able to cope with the negative effects of a pandemic, as market adjustments – and thus recovery – are faster (Candela and Geloso, 2021; Geloso and Bologna Pavlik, 2021) and people resort less to shadow activities (Berdiev et al., 2021). Hoekman et al. (2020), using the Netherlands as an example, claim that economic freedom does not mean less attention paid to the spread of a pandemic, nor a larger number of contagions. However, in this study, the authors adopt a descriptive approach and do not consider public spending nor other important components of economic freedom. Dayaratna et al. (2020) analyse the number of deaths due to COVID-19 in ten advanced economies with different degrees of economic freedom and conclude that there is no evidence that the degree of economic freedom and the number of deaths are somehow tied to each other.

Overall, the abovementioned studies consider economic freedom as a mono-dimensional phenomenon and, then, do not investigate whether its several dimensions may differently affect the health outcomes of epidemics or pandemics. Yet, this would be particularly important in order to inform policy and practice in times of infectious disease outbreaks. In fact, economic freedom is a multifaceted phenomenon encompassing different components of economic life that can have diverging effects and that, according to the main indices of economic freedom, can be summarised in five components: size of government, protection of property rights, monetary stability, freedom to trade internationally, and regulation. The impact of these components on health outcomes is currently understudied, although past research in various fields has provided evidence that they may have different effects on the same outcome, as in the case of economic growth (Carlsson and Lundström, 2002; Kešeljevič and Spruk, 2013; Saccone and Migheli, 2022), corruption (Goel and Nelson, 2005; Pieroni and d'Agostino, 2013) and risk of obesity in the OECD countries (Bleich et al., 2008). In light of the above considerations, it clearly emerges the need for more analytical studies that estimate the different relations existing between the various components of economic freedom, used as a proxy for liberalism, and the health effects of contemporary widespread diseases in a wide sample of countries. The present paper represents a novel empirical effort to address such a need.

3. Data and methodology

The study is based on an original dataset obtained from different sources, as detailed in Appendix, Table A1. It covers all OECD countries (listed in Appendix, Table A2) for the period 1970-2018, thus accounting for remarkable heterogeneity and evolution over time in both the patterns of mortality, our dependent variable, and in the prevailing policy orientations about economic freedom and liberalisation. The dependent variable is taken from the OECD Dataset "Health Status" and is "Influenza - deaths per 100 000 population (standardised rates)". Due to the lack of complete time series for economic freedom, years before 2000 are only covered once every five years, i.e. 1970, 1975, 1980, 1985, 1990, 1995.

Economic freedom is measured through the index computed by the Fraser Institute, which monitors the level of economic freedom in the world and publishes the report *Economic Freedom of the World* (EFW). The report was first presented in 1996 (Gwartney et al., 1996) and then published yearly since 2000. According to the Institute, "economic freedom is present when economic activity is coordinated by personal choice, voluntary exchange, open markets, and clearly defined and enforced property rights. People are economically free when they are permitted to choose for themselves and engage in voluntary transactions as long as they do not harm the person or property of others" (Gwartney at al., 2016, p. 1).

The EFW Report provides a numerical assessment – between 0 and 10 – of the degree of market liberalisation in a country, where higher values represent greater economic freedom. Specifically, the overall index measures the degree of economic freedom calculated as the average of the scores obtained in five different components, which are, in turn, average scores of relevant sub-components.[1] The definition of the five components, based on Gwartney et al. (2019), is as follows. '*Size of government*' captures the size of government spending, taxation, and government-controlled enterprises in an economy. '*Legal system and property rights*' is about the separation of powers and their proper functioning, and closely relates to the notion of rule of law. '*Sound money*' is mostly about inflation, which, according to the index proponents, affects the capacity of individuals to use economic freedom effectively by eroding the value of their wages and savings and introducing uncertainty about future values. '*Freedom to trade*

[1] It should be noticed that a higher score always corresponds to more economic freedom, regardless of the name of the components, which, in some cases, can be misleading. For example, countries scoring high in the component 'size of government' or in the sub-component "money growth" are the ones characterised by small size/growth, rather than big. Additional information can be found here: https://www.fraserinstitute.org/economic-freedom/approach

internationally' covers freedom to trade and do business with firms and individuals in other nations and includes tariff and non-tariff trade barriers and controls on the movements of capital and people. Finally, '*regulation'* refers to the regulation of the credit and labour markets and to the regulations of business activities. Table A3 in Appendix shows the coefficients of correlation between the overall index, each of its five components and the corresponding sub-components. Most correlations are high, statistically significant and positive, with the important exception of '*size of government'*, which is negatively and only sometimes significantly correlated with other (sub)components. This suggests that the exclusive use of the overall index may hide some of the effects of its components due, for instance, to compensations between '*size of government'* and '*legal system and property rights'* or '*freedom to trade internationally'*. At the same time, it recommends against the exclusive use of the size of government as a proxy for liberalism and economic freedom.

The analysis adopts a dynamic representation of the model, which takes the form:

$$D_{it} = \alpha + \beta D_{i,t-1} + \sum_k^K \gamma EF_{k,i,t} + \sum_\theta^\Theta \gamma_\theta X_{\theta,i,t} + \eta_i + u_{it} \quad [1]$$

where D_{it} is the number of deaths from flu (per 100 000 people) in year *t*, EF_{it} is economic freedom, alternatively measured by the EF overall index (Table 1, model *a*), by its K = 5 components (Table 1, model *b*), and by components and sub-components (Table 1, models *c-f*). X_{it} is a set of control variables, η_i is the country fixed-effect, and u_{it} is the error term. When potential endogeneity is considered, no great risks of reverse causality are detected: although high mortality from common diseases (like flu) could lead to pressure on government for more public efforts in the health system and, then, partially affect the level of economic freedom, this reverse effect is unlikely to take place within the same year due to information, decision and implementation lags (Saccone et al., 2022). When the omitted variable bias is considered, however, it is instead difficult to exclude that some variables might affect both mortality from flu and any of the components of economic freedom. The notion of economic freedom is, by its very nature, broad and the institutions it describes are historically and culturally grounded in the context of their countries. Similarly, the components and subcomponents used to build up the overall index are numerous and cover a broad range of sectors. These considerations make it difficult to exclude endogeneity from omitted variable bias.

For all these reasons and for the persistence of the process involved, the analysis employs the System GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) with Windmeijer

(2005) finite-sample correction. This should also limit the bias of potential – although unlikely – reverse causality that may exist. The two-step GMM estimator is used to improve the efficiency of the GMM estimator by using an optimal weighting matrix (Roodman 2009a and 2009b). Moreover, the System GMM estimator is preferred to the Difference-GMM estimator because of its better performance in panels with small N and highly or moderately persistent data (Blundell and Bond, 1998; Soto, 2009). The Diff-Hansen test is employed to verify the exogeneity of instruments in the level equation. The AR2 test (Arellano and Bond, 1991) is used to exclude autocorrelation of order 2, while the Hansen statistics (Hansen, 1982) test the validity of overidentifying restrictions. Since System-GMM is severely affected when the number of instruments is large compared to the number of cross-sectional units, the potential proliferation bias is mitigated by employing a version of the system GMM that collapses the GMM-style instruments (Roodman 2009a and 2009b). Where necessary, the number of instruments is further reduced by dropping deeper lags if the instruments count exceeds the number of countries, in order to keep the number of instruments below that of units. This restriction does not affect the properties of the estimator (Soto, 2009) and avoids the proliferation bias resulting from the use of the full set of instruments.

The selection of control variables is based on the existing literature on the determinants of health and flu mortality. They are: *real GDP per capita*, as average income broadly reflects the quality of the health system, the capacity of citizens to access healthcare services, and people's average living conditions which are likely to affect their health status (McMaughan et al., 2020); the *old-age dependency ratio*, as elders represent the most vulnerable group whose relative prevalence is expected to increase the deaths from flu in the total population (Hughes et al., 1996); *temperature anomalies*, measured as the difference between the temperature of the year and the average temperature of the period and divided by the latter, because hotter (colder) years are the ones when flu spreads the least (the most) (Postnikov, 2016; Ference et al., 2020)[2]. The descriptive statistics of the variables used in the analyses are shown in Table A4 in Appendix.

Robustness tests are presented in Table 2 and are run to check the sensitivity of results to the use of alternative samples and estimation techniques. To this goal, full model specification (model *b* in Table 1) is alternately estimated: a) by excluding extreme percentiles of the

[2] Average temperatures are not used as a regressor because countries' climate profile, which does not show much variation over time, is already captured by fixed-effects.

dependent variable (the interval 2.5-97.5 is used); b) by excluding multivariate outliers detected through the Hadi procedure (Hadi, 1992); c) with jackknife replications in order to assess the robustness of the results to the sample composition; d) and e) by excluding, by turns, middle-income countries and countries from former USSR. Similar tests are also performed on alternative specifications (models *c*, *d*, *e*, and *f* presented in Table 1) and their summary is available in Table 3.

Results

Table 1 presents the main estimates. When economic freedom is considered in its entirety and is measured by the overall EF index (model *a*), no statistically significant effect on flu mortality is found. This result may be due to the composite nature of the overall index: indeed, as other research has shown (e.g. Marson et al., 2021; Saccone and Migheli, 2022), the different components of the index may have effects with opposite signs on a given phenomenon, cancelling out each other when the overall index is used. Instead, when its five components are considered (model *b* and other models where subcomponents are also alternatively included among regressors as introduced onwards), some significant coefficients are found. The coefficient for '*legal system and property rights'* is always positive and statistically significant: countries with stronger legal systems and protection of property rights record more relative deaths from flu. This result is robust to different specifications. Conversely, '*sound money'* and '*freedom to trade internationally'* have negative and statistically significant coefficients (respectively in specifications *b*, *c*, and *f* and *b*, *d*, and *e*), suggesting that, as their values increase, the relative number of deaths from flu decreases. Also '*regulation'* presents a negative coefficient, which is, however, weakly significant only in specification *c*. The '*size of government*' has no statistically significant effect in specification *b*, but its coefficient becomes negative and statistically significant in specification *c.*

In order to better understand such results, the components are 'unpacked' one by one into their sub-components, which are used as regressors (Table 1, models *c-f*). This is not feasible for the component '*regulation*' because of the lack of detailed data for its sub-components. This step of the analysis aims at addressing two limitations potentially affecting model *b*. On the one hand, the same problem occurring when the overall index is used (model *a*) may affect the results of regressions that use its components as regressors. In other words, some sub-components of the

same component might have effects with different signs which cancel out at the component level. On the other hand, some sub-components may not affect the dependent variable; in this case, the proposed disaggregation allows to understand which of them contribute to driving the results obtained when the effect of the components was analysed. Specification *c* shows that the results of '*legal system and property rights'* is driven by the sub-component named '*protection of property rights'*, which has a positive and statistically significant coefficient; this suggests that countries whose policies have been emphasising the protection of property rights experience more relative deaths from flu. Correa (2002) suggests a possible explanation for this result: strong protection of patents on drugs generally decreases competition in the pharmaceutical sector and slows down research on new drugs. Moreover, the same author shows that the this also brakes pharmaceutical research in the public sector.

As the affordability of healthcare depends on public expenditure in the sector, one might have expected a positive and statistically significant coefficient for the component *'size of government'*, which was instead not significant.[3] Once it is decomposed into its different sub-components (specification *d*), the coefficient for '*government consumption'* turns out to be statistically significant with the expected positive sign, suggesting that countries whose government consumption is more limited record more deaths from flu. Such a result is interpretable in terms of affordability of healthcare systems: smaller government consumption is likely to reflect less resources invested in the public health system, which is generally more accessible for the poor than private systems, thus resulting in a lower number of patients receiving worse care from doctors and hospitals.

In the case of '*sound money'*, whose coefficient was negative and statistically significant in specification *b,* the driving sub-component is '*freedom to own foreign currency bank accounts'* (specification *e*). Although the interpretation of such result is not univocal, this may be related to a larger number of people who operate and maintain business relationships abroad, thus enabling their country to import more drugs and medical technologies. As shown in Appendix (Table A3), this sub-component is indeed highly and positively correlated with the freedom to trade internationally (0.52) and, especially, with its sub-component measuring the freedom of movement of capital and people (0.62). The decomposition of '*freedom to trade internationally*' in its sub-components provides further support to the interpretation proposed (specification *f*).

[3] It is important to recall that the score of a country in this respect increases as government expenditure decreases.

Indeed, its effect in specification *b* was driven by the sub-component '*controls of the movement of capital and people'*, which presents a negative and statistically significant coefficient. In other words, it may be argued that countries more open to exchanges of capital and people, for example through foreign direct investment, have better pharmaceutical and medical tools to reduce the mortality from flu.

Table 1 also allows also for some comments on the coefficients of the control variables. Although the results are not fully robust to the different specifications, all the signs are in line with expectations. It emerges that a positive and statistically significant path dependence of flu mortality exists, as the coefficient of the lagged dependent variable is positive and statistically significant. Moreover, results show that deaths from flu increase with the old-age dependency ratio because of the worse health conditions the elders, on average, have if compared with other age groups. The level of GDP per capita presents a negative and statistically significant coefficient, as better living standards prevent avoidable deaths; temperature anomalies show a negative effect, probably because hotter years (represented by a positive difference between the year temperature and the average) reduce the spread of and hence the mortality due to flu, while colder years (captured by a negative difference between the year temperature and the average) favour contagions and exacerbate the severity of flu symptoms because of possible superinfections with other pathogens emerging in cooler climates.

Table 1. Flu mortality and economic freedom (SYS-GMM)

			Detailing the sub-components of			
	Baseline	**Full model**	legal system & property rights	size of government	sound money	trade
	A	*b*	*c*	*d*	*e*	*f*
Deaths from flu (100 000 pop.) (first lag)	0.59***	0.11	0.23	0.28	0.34	0.23
	(5.7)	(0.28)	(1)	(1.5)	(1.59)	(0.76)
Real GDP per capita	0.01	-0.05**	-0.03	0.05	-0.03*	-0.04**
	(0.95)	(-2.2)	(-1.3)	(0.9)	(-1.7)	(-2.4)
Old-age dependency ratio	0.01	0.06	0.01	0.14*	0.05	0.04
	(0.68)	(1.11)	(0.18)	(1.79)	(1.22)	(0.66)
Temperature anomalies	-1.50**	-1.87	-1.30*	-0.69	-1.08	-1.78
	(-2.1)	(-1.6)	(-1.7)	(-0.5)	(-1.0)	(-1.0)
EF overall index	0.02					
	(0.3)					
Size of government		0.01	-0.85***		-0.08	-0.17
		(0.03)	(-3.2)		(-0.1)	(-0.4)

Government consumption				1.30*		
				(1.83)		
State ownership of assets				-0.07		
				(-0.1)		
Legal system & property rights		3.06***		1.55**	2.21***	2.51***
		(3.48)		(1.98)	(4.6)	(3.53)
Judicial independence			0.38			
			(0.63)			
Impartial courts			-0.25			
			(-0.3)			
Protection of property rights			1.06***			
			(3.25)			
Integrity of the legal system			0.91			
			(1.61)			
Gender legal rights adjustment			3.00			
			(0.5)			
Sound money		-1.17**	-0.82**	-0.46		-0.67*
		(-2.0)	(-2.0)	(-1.2)		(-1.8)
Standard deviation of inflation					-0.03	
					(-0.0)	
Inflation most recent year					-0.03	
					(-0.1)	
Freedom to own foreign currency bank accounts					-0.35*	
					(-1.9)	
Freedom to trade internationally		-0.88***	-0.26	-1.03**	-0.92***	
		(-2.6)	(-0.8)	(-2.4)	(-3.2)	
Tariffs						-0.01
						(-0.0)
Black market exchange rates						-0.35
						(-0.9)
Controls of the movement of capital and people						-0.31***
						(-4.1)
Regulation		-0.27	-0.10	-0.91*	-0.35	-0.41
		(-0.4)	(-0.2)	(-1.7)	(-0.7)	(-0.8)
Wald Chi-Squared test	304.01***	114.66***	134.13***	60.28***	186.52***	237.52***
AR2 test (p-value)	0.119	0.309	0.267	0.172	0.129	0.169
Hansen stat. (p-value)	0.282	0.271	0.223	0.418	0.208	0.186
Diff-Hansen (p-value)	0.548	0.482	0.409	0.364	0.508	0.862
Observations	804	804	804	804	804	804
Countries	38	38	38	38	38	38
Number of instruments	33	33	37	28	31	31

Note. Robust *z* statistic in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The AR2 test (p-value) refers to the Arellano and Bond (1991) test of autocorrelation of order 2; the Hansen (1982) statistics test the validity of overidentifying restrictions; the Diff-Hansen test verifies the exogeneity of instruments in the level equation (null hypothesis=exogeneity). A version of the system GMM that collapses the GMM-style instruments is employed *(*Roodman, 2009a and 2009b). Moreover, where necessary, the number of instruments is further reduced by dropping deeper lags if the instruments count exceeds the number of countries, so that the number of instruments is always kept below the number of units.

Table 2 presents some alternative specifications to provide the analysis with robustness checks. As detailed in the methodological section, these include alternative regressions without extremes values of the dependent variable (column *a*), without multivariate outliers (column *b*), with jackknife resampling (column c), without middle-income countries (column *d*), and without former USSR countries (column *e*). All the regressions are run for the full-model specification, corresponding to

column *b* of Table 1. The results appear robust to all the alternative regressions and fully confirm those presented above. The same robustness checks are also performed for the models *c-f* from Table 1, i.e. when the components of economic freedom are decomposed one by one into their sub-components, giving rise to six additional regressions. While full results are not reported (but are available upon request) to save space, Table 3 shows the estimated coefficients for each of the sub-components previously found to have a statistically significant effect on flu mortality: government consumption, protection of property rights, freedom to own foreign currency bank accounts, and controls of the movement of capital and people. Also in this case, previous findings are generally confirmed, although on two occasions they seem to be driven by those cases characterised by an extreme flu mortality. When the extreme values of the dependent variable are dropped or jackknife replications are performed, indeed, the coefficients for government consumption and for the controls of the movement of capital and people lose their statistical significance, suggesting that these two dimensions of economic freedom might be particularly relevant when flu mortality is particularly high.

Table 2: Robustness checks – model *b* (SYS-GMM)

	Without extremes	**Without outliers**	**Jackknife**	**Without MIC**	**Without USSR**
	a	*b*	*C*	*d*	*e*
Deaths from flu (100 000 pop.) (first lag)	0.23*	0.38***	0.11	-0.03	0.08
	(1.75)	(2.8)	(0.36)	(-0.0)	(0.25)
Real GDP per capita	-0.03***	-0.03*	-0.05*	-0.04**	-0.05**
	(-2.7)	(-1.7)	(-1.7)	(-2.1)	(-2.3)
Old-age dependency ratio	0.03	0.05	0.06	0.07*	0.06
	(1.31)	(1.23)	(1.13)	(1.71)	(1.12)
Temperature anomalies	0.35	-1.01	-1.87*	-1.77	-1.7
	(1.12)	(-1.2)	(-1.6)	(-1.3)	(-1.5)
Size of government	-0.28	0.18	0.01	0.39	0.05
	(-1.1)	(0.49)	(0.02)	(0.69)	(0.11)

Legal system & property rights	1.28***	2.42***	3.06***	3.16***	3.05***
	(5.75)	(4.85)	(3.81)	(4.13)	(3.84)
Sound money	-0.70**	-1.05**	-1.17**	-2.06***	-1.16**
	(-2.5)	(-2.1)	(-2.2)	(-2.7)	(-2.0)
Freedom to trade internationally	-0.15	-0.77**	-0.88**	-0.43	-0.87***
Regulation	(0.7)	(-0.3)	(-0.3)	(-0.2)	(-0.5)
Wald Chi-Squared test	132.38***	106.2***	-	122.98***	116.87***
AR2 test (p-value)	0.169	0.139	0.309	0.432	0.330
Hansen statistics (p-value)	0.286	0.299	0.271	0.499	0.348
Diff-Hansen (p-value)	0.449	0.888	0.482	0.594	0.859
Observations	696	795	804	732	755
Countries	38	38	38	34	35
Number of instruments	33	33	33	33	33

Note. Robust *z* statistic in parentheses (*t* for jackknife). *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Robustness checks – models *c-f* (SYS-GMM)

	Coeff. reported in Table 1	**Without extremes**	**Without outliers**	**Jackknife**	**Without MIC**	**Without USSR**
Government consumption (c)	1.30*	0.18	1.20**	1.30	2.18*	1.32**
	(1.83)	(0.95)	(2.04)	(1.41)	(1.77)	(2.08)
Protection of property rights (d)	1.06***	0.72**	0.89**	1.06**	1.76*	1.13***
	(3.25)	(2.06)	(2.24)	(1.99)	(1.89)	(3.18)
Freedom to own foreign currency	-0.35*	-0.12**	-0.36**	-0.35**	-0.58**	-0.38**
bank accounts (e)	(-1.9)	(-2.00)	(-2.03)	(-2.01)	(-2.55)	(-1.99)
Controls of the movement of capital	-0.31***	-0.04	-0.27***	-0.31	-0.33*	-0.28**
and people (f)	(-4.1)	(-0.45)	(-3.05)	(-1.58)	(-1.94)	(-2.57)

Note. Robust *z* statistic in parentheses (*t* for jackknife). *** p<0.01, ** p<0.05, * p<0.1.

Conclusions

Economic liberalism concretely results in a wide range of policies aimed at promoting people's freedom to choose, trade, compete and own, as extensively defined by the Fraser Institute. As a consequence, understanding how policies inspired by liberalism may affect people's health is possible only if the effects of its various domains are studied separately. For this purpose, the analysis presented in this paper has aimed at empirically testing whether a connection exists between the different components of economic freedom, used as a proxy for liberalism, and the deaths due to seasonal flu. Findings show that: a) not every component of economic freedom has

an effect on flu mortality; b) when an effect is detected, more economic freedom not always means less (or more) deaths from flu. In particular, the following three main results emerge and give rise to policy considerations.

First, strong protection of property rights (associated, ceteris paribus, with a higher degree of economic freedom) may lead to more deaths from flu, as this is likely to hamper competition, innovation and public involvement in the pharmaceutical sector. *Second*, the extent government consumes, and consequently spends on public health, affects the number of relative casualties due to seasonal flu: higher public consumption (i.e., other things being equal, a lower degree of economic freedom) is indeed associated with lower mortality stemming, probably, from a better affordability of healthcare systems and quality of the healthcare it offers. *Third*, flu mortality is lower when people and capital are freer to move (meaning, ceteris paribus, more economic freedom), probably due to larger exchanges of goods, services and knowledge, in particular in the medical and pharmaceutical sectors. It is worthy underling that such policy considerations, which may have policy implications, seem to be particularly relevant for those countries characterised by an older population and/or poorer living standards, as they may be most affected by the adverse health consequences of flu.

Although such results may contribute to inform policymakers about which actions can limit the mortality of a globally widespread disease like flu, further research is needed. First, new studies may consider alternative measures of liberalism and economic freedom, also enlarging the scope to different varieties of capitalism (Thelen, 2012). Second, similar analyses should be carried out about the effects that economic freedom and its components have on the spread and mortality of other common infections; in particular, it would be relevant to study which of them are contributing to spread or, conversely, limit the health impacts of the COVID-19 pandemic, as urgent actions need to be taken and the debate on their effectiveness is open (Kaplan et al., 2022). Third, as far as data are available, the relations between economic liberalism and mortality from common infections should be studied by including also poorer economies, where most of the global deaths from preventable or curable diseases occur.

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Appendix - Data sources and descriptive statistics

Table A1: Variables and sources of data

Variables	Full name, description	Source
EF indices	Overall index, components and sub-component indices (see data and methodology for description)	https://www.fraserinstitute.org/economic-freedom/dataset
Deaths from flu	Influenza deaths per 100 000 population (standardised rates)	OECD https://doi.org/10.1787/data-00540-en
Real GDP per capita	GDP per capita (constant 2010 US$)	databank.worldbank.org/source/world-development-indicators
Old-age dependency ratio	Age dependency ratio, old (% of working-age population)	databank.worldbank.org/source/world-development-indicators
Temperature anomalies	[(Mean temperature of the year - period average)/ period average]	(CRU data) https://climateknowledgeportal.worldbank.org/

Table A2: Countries in the sample: OECD countries

Australia	Denmark	Ireland	Mexico	Spain
Austria	Estonia	Israel	Netherlands	Sweden
Belgium	Finland	Italy	New Zealand	Switzerland
Canada	France	Japan	Norway	Turkey
Chile	Germany	Korea	Poland	United Kingdom
Colombia	Greece	Latvia	Portugal	United States
Costa Rica	Hungary	Lithuania	Slovak Republic	
Czech Republic	Iceland	Luxembourg	Slovenia	

Table A3: Correlation matrix in the main sample (with p-values)

	EF overall index	Government consumption	State ownership of assets	**Size of government**	Judicial independence	Impartial courts	Protection of property rights	Integrity of the legal system	Gender legal rights adjustment	**Legal system & property rights**	St. dev. of inflation	Inflation: Most recent year	Freedom to own foreign currency bank accounts	**Sound money**	Tariffs	Black market exchange rates	Controls of the movement of capital and people	**Freedom to trade internationally**	**Regulation**
EF overall index	1.00																		
Government consumption	-0.19	1.00																	
	0.00																		
State ownership of assets	0.55	0.10	1.00																
	0.00	0.01																	
Size of government	0.29	0.67	0.43	1.00															
	0.00	0.00	0.00																
Judicial independence	0.57	-0.41	0.17	-0.16	1.00														
	0.00	0.00	0.00	0.00															
Impartial courts	0.56	-0.46	0.16	-0.20	0.89	1.00													
	0.00	0.00	0.00	0.00	0.00														
Protection of property rights	0.45	-0.44	0.11	-0.28	0.76	0.79	1.00												
	0.00	0.00	0.00	0.00	0.00	0.00													
Integrity of the legal system	0.53	-0.53	0.10	-0.31	0.77	0.77	0.74	1.00											
	0.00	0.00	0.00	0.00	0.00	0.00	0.00												
Gender legal rights adjustment	0.25	-0.23	0.13	-0.11	0.23	0.18	0.12	0.18	1.00										
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
Legal system & property rights	0.63	-0.48	0.20	-0.21	0.89	0.86	0.79	0.85	0.43	1.00									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00										
Standard deviation of inflation	0.56	-0.08	0.25	0.02	0.21	0.18	0.23	0.20	0.10	0.22	1.00								
	0.00	0.03	0.00	0.58	0.00	0.00	0.00	0.00	0.01	0.00									
Inflation: Most recent year	0.72	-0.21	0.36	0.06	0.26	0.25	0.24	0.28	0.12	0.29	0.72	1.00							
	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00								
Freedom to own foreign currency bank accounts	0.70	-0.25	0.41	0.15	0.26	0.33	0.25	0.34	0.12	0.33	0.29	0.46	1.00						
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Sound money	0.83	-0.22	0.42	0.11	0.31	0.34	0.31	0.36	0.13	0.36	0.76	0.84	0.79	1.00					
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Tariffs	0.26	-0.13	0.19	-0.15	0.18	0.16	0.08	0.21	0.01	0.15	0.14	0.22	0.11	0.20	1.00				
	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.88	0.00	0.00	0.00	0.00	0.00					
Black market exchange rates	0.47	-0.18	0.24	0.04	0.18	0.20	0.12	0.23	0.09	0.20	0.25	0.46	0.26	0.38	0.33	1.00			
	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00				
Controls of the movement of capital and people	0.70	-0.27	0.32	0.02	0.37	0.39	0.30	0.41	0.18	0.42	0.31	0.49	0.60	0.60	0.28	0.33	1.00		
	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Freedom to trade internationally	0.72	-0.32	0.34	-0.07	0.42	0.44	0.33	0.47	0.16	0.45	0.33	0.55	0.52	0.59	0.63	0.63	0.85	1.00	
	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Regulation	0.83	-0.28	0.45	0.17	0.48	0.47	0.38	0.40	0.23	0.53	0.42	0.59	0.49	0.60	0.07	0.33	0.46	0.45	0.75
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00

Table A4. Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Deaths from flu (per 100 000 pop.)	804	1.66	3.62	0.00	35.10
Real GDP per capita (thousands)	804	33,899.68	21,006.02	3,385.72	11,1968.30
Old-age dependency ratio	804	21.59	6.50	6.05	46.17
Temperature anomalies	804	0.07	0.21	-1.46	1.32
EF overall index	804	7.51	0.71	3.82	8.76
Size of government	804	6.16	1.02	2.33	8.47
Government consumption	804	4.47	1.74	0.00	9.35
State ownership of assets	804	7.81	1.20	3.78	10.00
Legal system & property rights	804	7.04	1.01	3.48	8.49
Judicial independence	804	6.50	1.05	2.71	8.00
Impartial courts	804	6.19	1.13	3.42	8.03
Protection of property rights	804	6.45	0.80	3.97	7.93
Integrity of the legal system	804	7.67	1.09	3.31	8.93
Gender legal rights adjustment	804	0.98	0.07	0.22	1.00
Sound money	804	8.92	1.31	0.00	9.92
Standard deviation of inflation	804	9.15	1.28	0.00	9.95
Inflation most recent year	804	9.09	1.35	0.00	10.00
Freedom to own foreign currency bank accounts	804	8.76	2.81	0.00	10.00
Freedom to trade internationally	804	8.10	0.95	1.93	9.96
Tariffs	804	8.13	0.98	1.91	9.99
Black market exchange rates	804	9.86	0.81	0.00	10.00
Controls of the movement of capital and people	804	6.71	2.12	0.00	10.00
Regulation	804	7.34	1.02	2.03	9.24