Did Child Restraint Laws Globally Converge? Examining 40 Years of Policy Diffusion

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Objective: The objective of the current study is to determine what factors have been associated with the global adoption of mandatory child restraint laws (ChRLs) since 1975.

Methods: In order to determine what factors explained the global adoption of mandatory ChRLs, Weibull models were analyzed. To carry out this analysis, 170 countries were considered and the time risk corresponded to 5,146 observations for the period 1957–2013. The dependent variable was first time to adopt a ChRL. Independent variables representing global factors were the World Health Organization (WHO) and World Bank’s (WB) road safety global campaign; the Geneva Convention on Road Traffic; and the United Nation’s (UN) 1958 Vehicle Agreement. Independent variables representing regional factors were the creation of the European Transport Safety Council and being a Commonwealth country. Independent variables representing national factors were population; gross domestic product (GDP) per capita; political violence; existence of road safety nongovernmental organizations (NGOs); and existence of road safety agencies. Urbanization served as a control variable. To examine regional dynamics, Weibull models for Africa, Asia, Europe, North America, Latin America, the Caribbean, and the Commonwealth were also carried out.

Results: Empirical estimates from full Weibull models suggest that 2 global factors and 2 national factors are significantly associated with the adoption of this measure. The global factors explaining adoption are the WHO and WB’s road safety global campaign implemented after 2004 (P < .01), and the UN’s 1958 Vehicle Agreement (P < .001). National factors were GDP (P < .01) and existence of road safety agencies (P < .05). The time parameter ρ for the full Weibull model was 1.425 (P < .001), suggesting that the likelihood of ChRL adoption increased over the observed period of time, confirming that the diffusion of this policy was global.

Conclusions: Results of the world models suggest that the WHO and WB’s global road safety campaign was effective in disseminating ChRLs after 2004. Furthermore, regions such as Asia and Europe and North America were early adopters since specific regional and national characteristics anticipated the introduction of this policy before 2004. In this particular case, the creation of the European Transport Safety Council was fundamental in promoting ChRLs. Thus, in order to introduce conditions to more rapidly diffuse road safety measures across lagging regions, the maintenance of global efforts and the creation of road safety regional organizations should be encouraged. Lastly, the case of ChRL convergence illustrates how mechanisms of global and regional diffusion need to be analytically differentiated in order better to assess the process of policy diffusion.

Keywords: diffusion, child restraints, globalization, convergence

Introduction

In 2004, the World Health Organization (WHO) and the World Bank (WB), along with many other important national and international actors, all part of the United Nations Road Safety Collaboration network, launched and implemented a global campaign to promote several road safety measures in order to tackle the root causes of road crashes and avoid their consequences (Peden et al. 2004). In this campaign, one of the most highlighted measures, given its efficacy in reducing both fatality and morbidity rates, was the promotion of child restraint laws (ChRLs). In the 29 years from 1975, the year in which Belgium and Denmark enacted the first 2 ChRLs in the world, up until the launching of this global campaign in 2004, only 47 countries had enacted this measure. However, in the subsequent 9 years from 2004 to 2013, an increase of 61% of ChRLs across the world was observed, with 37 more countries adopting ChRL policies. The role of the WHO and the WB’s global campaign, or any other regional or national factor, in this impressive policy adoption pattern across the world remains unknown.

A vast body of literature from different disciplines such as political science, economics, international relations, and sociology has researched the global diffusion and convergence of
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public policies. Under this particular rubric we find analyses that have focused on economic policies (Brooks 2005; Chang and Strang 2008; Kogut and Macpherson 2008, 2011; Weyland 2005), health policies (Gilardi et al. 2009; Iriart et al. 2001; Luke and Watkins 2002; Wipfli et al. 2010), and political public policies, such as democracy, human rights laws, and anti-terrorism laws (Gleditsch and Ward 2008; Hafner-Burton and Tsutsui 2005; Pegram 2010; Shor 2008, 2013; Shor et al. 2014). With the sole exception of Sochor et al. (2014), who examined the use of the Abbreviated Injury Scale across the world, academics interested in the global diffusion and convergence of public policies have not examined road safety policies. This is surprising, given that road traffic accidents represent the eighth leading cause of death across the world (Lozano et al. 2012). In order to fill this gap in the literature, we analyze the diffusion and convergence of ChRLs.

In this article, we contribute to the literature on global diffusion and convergence of public policy by using cross-national data for the period 1957–2013. We empirically assess the effects of global, regional, and national factors on the adoption of ChRLs. The global mechanisms of diffusion were (1.1) the WHO and the WB road safety global campaign; (1.2) the Geneva Convention on Road Traffic; and (1.3) the United Nations’ 1958 Vehicle Agreement. The regional factors were (2.1) Existence of a road safety council at the regional level and (2.2) Formal membership in the Commonwealth. The national factors examined were (3.1) Population; (3.2) gross domestic product (GDP); (3.3) political violence; (3.4) existence of road safety nongovernmental organizations (NGOs); and (3.5) existence of road safety agencies. Particular attention will be given to specific analysis of world regions (i.e., Africa, Asia, Europe and North America, and Latin America and the Caribbean) because the adoption rate of this policy may behave differently in each region and thus models that focus exclusively on the global level can overshadow regional dynamics. Such an assessment is highly relevant for the development of road safety policies and public policies in general. This research should have implications for how best to accelerate the current diffusion process of this particular policy, as well as shed light on how to improve other diffusion processes that may be in the early stages of development.

However, this study also has both theoretical and methodological implications for the field of global diffusion and convergence of public policies more generally. By empirically examining global, regional, and national factors independently, we can identify what specific mechanisms of diffusion operate at each level of analysis. This analytical strategy also allows us to better identify the presence and influence of innovators, early and late adopters (Rogers 1962; Wejnert 2002) for each region, because regions may adopt this policy at different temporal stages. Second, from a methodological perspective, this analysis departs in one important way from many existing studies of the global diffusion and convergence of public policies. As Marsh and Sharman (2009) have noted, those studies are more likely to analyze single case studies, focusing on national processes. Though these studies have greatly contributed to our understanding of local dynamics in policy adoption, this approach does not offer explanations of how different convergence mechanisms operate at the global and regional levels. Indeed, in the area of road safety, studies carried out by Chandran et al. (2014) and Nazif-Muñoz et al. (2014) are examples of case studies that report global convergence in Mexico and Chile, respectively, but it is unknown how generalizable their findings are. Studying a sample of more than 170 countries for a 40-year period of policy development provides a more comprehensive approach to test the generalizability of global convergence mechanisms of road safety policy. The present study proposes an empirical contribution to this literature by examining how the adoption of ChRLs across the world aligns with previous research, thereby expanding our knowledge of global diffusion and convergence of public policies more generally and informing us of what can be done to promote the adoption of road safety policies more efficiently.

Research Question

Figure 1 shows the steady spread in the global adoption of mandatory ChRLs between 1971 and 2013. There appear to be 2 distinctive periods, however, which deserve closer attention: From 1975 to 2004, 47 countries had enacted ChRLs, and from 2004 to 2013 37 more countries followed. Recall that 2004 was the year in which the WB and the WHO launched their global road safety campaign. Hence, our research question is: to what extent does the introduction and implementation of the WHO and the WB’s road safety campaign explain the adoption of mandatory ChRLs across the world after the year 2004?

At the same time, as we can observe in Figure 1, there was a steady spread of ChRLs already starting from 1990. Consequently, there are other elements at work that should be closely examined to avoid biasing our analysis too heavily toward the 2004 campaign as the major causal factor. For instance, decisions to adopt ChRLs may be influenced by regional and national dynamics that countries face independently of any global forces. More particularly, regional road safety councils, the presence of a road safety agency, road safety NGOs, and large populations can all create conditions favorable to the adoption of this measure independently of any global factors.
Methods

Approach

To obtain valid estimates to test for the mechanisms of global convergence and adoption of ChRLs, we employ survival analysis. This method enables us to explain events occurring in countries over a specified period of time (Cleves 2010; Jenkins 2005; Strang 1994b; Tuma and Hannan 1984). Survival analysis has been used to study various types of events ranging from decolonization (Strang 1994a) to policy adoption (Jordana et al. 2011; Kogut and Macpherson 2008; Murillo and Martinez-Gallardo 2007; True and Mintrom 2001; Wotipka and Ramirez 2008).

Unlike ordinary least square regression and logistic regression models, this type of statistical analysis can assess nonnormally distributed dependent variables and handle censoring (Cleves 2010). In survival time data, the observations represent periods and contain 3 variables recording the start time of the period (the first time a ChRL was ever enacted; e.g., 1975, when Denmark and Belgium enacted the first ChRL), the end time (the last year in which there is information for every country in the sample; e.g., 2013), and an indicator of whether failure or right-censoring occurred at the end of the period (the year in which each country enacted its ChRL before 2014).

There are a variety hazard functions, including Weibull, Gompertz, lognormal, and exponential, for different probability distributions of failure times.\(^1\) We use the shape parameter \(\rho\) of the Weibull function of the survival analysis model here because it permits us to assess whether the adoption rate of ChRL of the countries follows global and/or regional trends. In reporting the results, following Kogut and Macpherson (2008), we call this shape parameter “time” because its sign indicates whether baseline adoption increases or slows down during the observed period (1975–2013). If the adoption process was a response to a national stimulus, with those countries most predisposed to ChRL adopting first, the baseline hazard would not increase and be lower than 1. If instead an ongoing global or regional process is boosting the adoption of ChRL, an increase in the baseline hazard should be observed and be higher than 1.

Heterogeneity could be a result of modeling countries as if they had been equally exposed to the same time risk. To avoid this, we defined the onset of risk for the adoption of ChRL from the year in which the country acquired national independence. If the country had obtained independence before the year in which the first ChRL was enacted, its exposure to ChRL adoption started in 1975. Information about countries’ independence was obtained from the Central Intelligence Agency’s World Factbook (Central Intelligence Agency 2014).

Lastly, we adjusted the estimates for the adoption time rates in reference to 22 regional clusters because we assumed that countries might have exchanged road safety policy information within these regions. Without accounting for within-region correlation, our estimators would be misspecified (Cleves 2010). In order to account for this potential bias, we applied the vce (cluster region) function of Stata 12 (StataCorp 2013), which specifies that the standard errors allow for intragroup correlation, relaxing the requirement that the observations be independent. In other words, we model under the assumption that the observations are independent across regions but not necessarily within.

Data

To examine the adoption process of ChRLs across the world, we compiled data on 170 countries between 1957 and 2013 based on availability.

Dependent Variable

Our dependent variable is enactment of ChRLs. These laws, beginning with their first adoptions in 1975, were coded from the WHO global reports on road safety (Peden et al. 2004; WHO 2009, 2013), national laws, peer-review journals, and governmental and international organization reports. We defined ChRL enactment as the first time any national legislation imposed mandatory use of infant seats, irrespective of children’s age and/weight, and whatever the type of seat or booster the law defined.\(^2\) For instance, if a country made the use of these devices mandatory for children less than 8 years old and another country did so for children less than 5 years old, both countries were regarded as cases of ChRL enactment.\(^3\) For each year during the 1975–2013 period we treated policy adoption as an event that either did or did not occur; thus allowing us to examine the rate at which countries adopted ChRL over time. Thus our dependent variable, “First adoption of ChRL,” is dichotomous, taking on the value of 0 in all the years in which countries had not adopted ChRL and 1 for the year in which countries had regulated ChRLs for the first time.

Independent Variables

The set of independent variables consists of the following operationalizations of global, regional, and national factors:

1. Global factors:
   1.1 global road safety campaign. In 2004, the WHO and the WB launched and led a global campaign to promote the implementation of road safety measures in order to reduce the toll of traffic fatality and injury across the world (WHO 2009, 2013). From 2004 onward these organizations have produced a series of reports and carried out

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\(^1\)In order to assess the robustness of the results of the Weibull models, Exponential, Gompertz, Lognormal and Cox regression models were also carried out when assessing the world sample. Results are consistent with the Weibull models and available upon request.

\(^2\)For the cases of the United States and Canada, we coded the year in which the last state and province enacted ChRLs, respectively.

\(^3\)Because the objective was to determine when the country in question adopted ChRLs for the first time, subsequent changes that countries implemented in regards to these legislations, such as having increased the mandatory age or weight of the children, were not analyzed.
several world and regional forums to publicize and endorse a series of road safety best practices. This variable is dichotomous, 0 for the period before 2004, representing the absence of the global campaign, and 1 for the period from 2004 onwards, representing the launching and conduct of the global campaign. It is expected that after 2004 countries were more likely to adopt ChRLs than before.

1.2 The Geneva Convention on Road Traffic. This United Nations (UN) convention was designed to promote the development of traffic safety by establishing certain uniform rules. Information about countries and the date their governments signed the convention is provided by the UN (2014b). This variable captures the year in which a country formally ratified this convention and is dichotomous as well, with 0 corresponding to the period before the signature and 1 to the period after having signed the convention. It is expected that a country that has signed this convention is more likely to have adopted or to adopt ChRLs, because signing the convention is an indicator of successful advocacy of road safety best practices.

1.3 United Nations’ 1958 Vehicle Agreement. This agreement, formally entitled Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts Which Can Be Fitted and/or Be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of These Prescriptions (UN 2008), provides the legal framework allowing contracting parties (member countries) to establish regulatory instruments concerning road safety. More specifically, this agreement set the conditions to formally discuss provisions concerning child restraint systems. In this regard, it regulated matters such as definitions of what constituted a child restraint system, categories (e.g., universal, restricted, built-in), conformity of production and routine tests, or penalties for nonconformity of production, among others (UN 2008). Information about countries and the date of their signing of the Agreement is provided by the UN (2014a). Like the variable for the Geneva Convention, this variable was dichotomous, with 0 corresponding to the period before the signature and 1 to the period after having signed the agreement. It is expected that countries that signed this agreement are more likely to adopt ChRLs.

2. Regional factors:

2.1 Creation of the European Transport Safety Council. Founded in 1993, this organization has provided road safety expertise to members of the European Commission and European Parliament. It has brought together more than 200 transport safety experts and organizes an annual conference on road safety (European Transport Safety Council 2008). This variable, only used in modeling effects in European countries, is dichotomous, with 0 corresponding to the period before 1993, representing the absence of this institution, and 1 to the period from 1993 onwards, representing its presence. It is expected that after the foundation of this institution, European countries were more likely to adopt ChRLs than before.

2.2 Commonwealth membership. This is a group of 53 countries, which was founded in 1949, whose roots go back to the British Empire. Membership identification can be obtained from the Commonwealth (2014). This variable was dichotomous, with 0 for non-Commonwealth countries and 1 for members of the Commonwealth. It is expected that Commonwealth countries are more likely to adopt ChRLs, because the United Kingdom, Australia, and New Zealand were pioneers in enacting ChRL in the world.

3. National factors:

3.1 Population. It is expected that countries with large populations are more likely to enact road safety legislations because this variable is directly related to increasing exposure to road risk (Sivak and Tsimhoni 2008). Population data were obtained from the World Bank (2013).

3.2 Gross domestic product. Economic development may increase a nation’s ability to tackle road safety challenges (Kopits and Cropper 2005). In this regard, we employ a measure of GDP per capita at purchasing power parity with the U.S. dollars for the year 2000. These data can be obtained from the World Bank (2013). We expect that GDP per capita increases the likelihood of ChRL adoption.

3.3 Political violence. Political violence is defined by the systematic and sustained use of lethal violence by organized groups that results in at least 500 directly related deaths over the course of the episode. Each episode is designated to span a certain number of years and judged to have been of a certain, general “magnitude of societal systemic impact.” An 11-point scale ranging from 0 to 10 gathered by the Center for Systemic Peace was used (Marshall 2014). It is expected that countries are more likely to delay the adoption of ChRLs if state attention is diverted toward solving episodes of political violence rather than tackling road safety challenges.

3.4 Existence of road safety NGOs. The presence of a road safety NGO in each country represents whether a country has this type of institution. Information was obtained from the Global Alliance for NGOs for Road Safety (2014). This variable was dichotomous, in which 0 corresponds to countries without membership, and 1 represents countries with membership. It is expected that countries with these types of organizations are more likely to adopt ChRLs.
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Control Variables
Following the existing literature one control variable was taken into account:

- Urbanization. This variable consists of the percentage of a country’s population living in urban areas (percentage urban). The data can be obtained from the World Bank (2013). It is expected that urbanization will increase the enactment of ChRLs because it is linked with a growth of the vehicle fleet, which in turn is likely associated with an increase in road crashes (Grimm and Treibich 2010).

Table 1 reports the descriptors for both independent and control variables and Table 2 reports the correlations between independent and control variables.

Results
Because we think that global, regional, and national factors may have different effects on the adoption of ChRLs, we present our results for each of these levels in turn.

Global Factors Affecting the Adoption Rate of ChRLs
Table 3 provides the results of 2 global models for the adoption of ChRLs:\(^4\) Model 1, in which we did not introduce 2 relevant national factors (political violence and existence of a road safety agency) that could influence the adoption of ChRLs; and model 2, in which these two variables were included. Model 2 therefore constitutes a more rigorous examination to test whether the adoption trend of this policy is due to global factors or not. We log-transformed the following variables to account for their skewed distribution: Population, GDP per capita, and political violence. Regarding the effects of the global variables, we observe the following results across models 1 and 2: First, model 1 displays a significant increase of ChRL adoption over time and across countries, with (\(\rho\)) = (1.577). This parameter suggests that global forces have indeed contributed to convergence on this policy. In model 2 we observe the same tendency. Though the parameter of this model is slightly lower (1.425), it nonetheless remained statistically significant after the existence of a road safety agency was introduced.

Second, in regards to the mechanisms of global diffusion, we notice that the road safety global campaign has a statistically significant association with the adoption rate of ChRL. The estimated hazard ratio is 2.253 and 1.992 in models 1 and 2, respectively, implying that countries were about twice as likely to adopt this measure after the launching the global road safety campaign. In model 2 the hazard ratio of this variable decreases slightly because the variable representing the road safety agency was introduced. Altogether, these results provide strong evidence that this campaign was effective in diffusing this policy after the year 2004.

Third, we also notice in Table 3 that the United Nations’ 1958 Vehicle Agreement is significant at \(P < .001\) in both models, suggesting that this agreement may have had some influence in the decision of adopting ChRL. We observe that countries that signed this agreement were at least 3 times more likely to adopt this measure than non-signatories. In regards to the Geneva Convention, we notice in model 1 that this variable is statistically significant when assessing the enactment of ChRLs. However, this variable did not attain statistical significance in the full model. This effect could have been absorbed by the existence of road safety agency variable.

Regional Factors Affecting the Adoption Rate of ChRLs
In Table 4 we report on models for 4 geographical regions (Africa, Asia, Europe and North America, Latin America and the Caribbean) and for the Commonwealth. First, we observe a significant increase of adoption over time and across countries for Asia, Europe and North America, and Latin America and the Caribbean whose \(\rho\) values were 2.306, 1.807, and 21.792, respectively. This suggests that specific regional forces are associated with convergence on ChRLs. In regards to Africa we observe a positive parameter (1.777), but it is not statistically significant, suggesting that this region does not have regional characteristics that foster the adoption of this measure. Lastly, because the parameter of the group of Commonwealth countries is lower than 1 (0.976), we cannot assume that unique Commonwealth characteristics can be associated with the adoption of ChRLs across these countries.

When we analyze the independent variables for each region, several interesting dynamics emerge. First, only in Africa (model 3) did the global road safety campaign have a significant positive impact. In this region we also notice that, contrary to our theoretical expectation, countries that signed the UN’s 1958 Vehicle Agreement were more likely to delay the adoption of this policy. Second, only in Asia (model 4) were signatories to the Geneva Convention on Road Traffic more likely to adopt ChRLs. Third, we observe that in Europe and North America (model 5), the creation of the European Transport Safety Council had a positive impact on the adoption rate of this policy. In regards to the Latin American and the Caribbean region we observe, unlike of what we expected, that the estimate of the global road safety campaign (model 6) is significantly negative, denoting that after this campaign the rate of adoption was significantly delayed. In other words, only few Latin American and Caribbean countries have adopted ChRLs, and those who have can be regarded as late adopters. For instance, Costa Rica, Trinidad and Tobago, and Uruguay only adopted ChRLs after 2010, and the majority of countries in this region has not yet adopted this measure. We observe, however, that countries in this region with ties to the Commonwealth, which are mostly Caribbean, are more likely to adopt this policy, and this could be the reason why the \(\rho\) in this model is positive and statistically significant. Lastly, we observe that the adoption rate of Commonwealth countries is not directly associated with global factors. When we as-

\(^4\)In Table A1 (see online supplement) we report which countries were part of each model.
Table 1. Descriptive statistics of control and independent variables, grouped by theoretical approach

| Variables                          | Source                                      | Years        | Mean   | SD     | Min | Max |
|-----------------------------------|---------------------------------------------|--------------|--------|--------|-----|-----|
| **Controls**                      |                                             |              |        |        |     |     |
| Urbanization                      | World Bank (2013)                           | 1950–2013    | 46.418 | 24.177 | 2.115 | 100 |
| **Global factors**                |                                             |              |        |        |     |     |
| The road safety global campaign   | World Health Organization (2004)            | 1957–2013    | 0.113  | 0.316  | 0   | 1   |
| Geneva Convention on Road Traffic | United Nations (2014a)                      | 1949–2013    | 0.418  | 0.493  | 0   | 1   |
| United Nations’ 1958 Vehicle Agreement | United Nations (2014b)                 | 1958–2013    | 0.108  | 0.310  | 0   | 1   |
| **Regional factors**              |                                             |              |        |        |     |     |
| Creation of the European Transport Safety Council | European Transport Safety Council (2008) | 1957–2013    | 0.088  | 0.283  | 0   | 1   |
| Commonwealth country              | Commonwealth (2013)                         | 1957–2013    | 0.267  | 0.442  | 0   | 1   |
| **National factors**              |                                             |              |        |        |     |     |
| Gross Domestic Product per capita (ln) | World Bank (2013)                           | 1950–2013    | 7.205  | 1.602  | 3.565 | 11.626 |
| Population (ln)                   | World Bank (2013)                           | 1950–2013    | 15.252 | 2.069  | 9.200 | 21.004 |
| Political violence (ln)           | Marshall (2014)                             | 1957–2013    | 0.222  | 0.537  | 0   | 2.890 |
| Existence of road safety NGOs     | Global Alliance for NGOs for Road Safety (2014) | 1957–2013    | 0.659  | 0.473  | 0   | 1   |
| Road Safety Agency                | Multiple sources (1957–2013)                | 1957–2013    | 0.185  | 0.388  | 0   | 1   |

In Tables 3 and 4 we observe how national factors affect both the global and regional samples. In the global sample (Table 3) we observe that adoption rates of ChRLs are strongly associated with GDP in models 1 and 2. One important finding is related to the role that road safety agencies perform when adopting road safety measures. In model 2 we observe that this variable is significant at $P < .05$ and its hazard rate suggests that countries with road safety agencies are twice as likely to enact ChRLs as countries without these organizations. We also observe that specific types of national characteristics within regions explain adoption rates of this legislation. In this study we provide evidence of how the adoption rate of ChRLs across the world is a function of a combination of global, regional, and national factors. One important finding of this study is the effectiveness of the global road safety campaign in the dissemination of this policy after 2004. More precisely, after this campaign was introduced we observe, regardless of what national forces were at play, a significant increase in the adoption of ChRL. Furthermore, results show that adoption rates follow different patterns when regional analyses are carried out. More specifically, within Asia, countries that signed the Geneva Convention on Road Traffic were more likely to adopt this measure. In Europe, the presence of its European Transport Safety Council appears to have led to an increase in the adoption rate of ChRLs. In Africa, after the launching of the global campaign we observed a steady increase in the adoption of ChRLs. In Asia, conversely, we observe that the only significant association of national factors with ChRL adoption is GDP; however, unlike of what we expected, this relationship is negative—that is, high-income countries in this region were more likely to delay the implementation of this regulation. Lastly, the Commonwealth case displays a very interesting pattern because the presence of a road safety agency is the only factor that increases the hazard rate of adopting ChRL.

### Discussion

In this study we provide evidence of how the adoption rate of ChRLs across the world is a function of a combination of global, regional, and national factors. One important finding of this study is the effectiveness of the global road safety campaign in the dissemination of this policy after 2004. More precisely, after this campaign was introduced we observe, regardless of what national forces were at play, a significant increase in the adoption of ChRL. Furthermore, results show that adoption rates follow different patterns when regional analyses are carried out. More specifically, within Asia, countries that signed the Geneva Convention on Road Traffic were more likely to adopt this measure. In Europe, the presence of its European Transport Safety Council appears to have led to an increase in the adoption rate of ChRLs. In Africa, after the launching of the global campaign we observed a steady increase in the adoption of ChRLs. In Asia, conversely, we observe that the only significant association of national factors with ChRL adoption is GDP; however, unlike of what we expected, this relationship is negative—that is, high-income countries in this region were more likely to delay the implementation of this regulation. Lastly, the Commonwealth case displays a very interesting pattern because the presence of a road safety agency is the only factor that increases the hazard rate of adopting ChRL.

Table 2. Correlation among independent and control variables

|                  | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
|------------------|------|------|------|------|------|------|------|------|------|------|
| 1. Urbanization  | 1    |      |      |      |      |      |      |      |      |      |
| 2. The road safety global campaign | 0.14* | 1    |      |      |      |      |      |      |      |      |
| 3. Geneva Convention on Road Traffic | 0.22* | 0.05* | 1    |      |      |      |      |      |      |      |
| 4. United Nations’ 1958 Vehicle Agreement | 0.36* | 0.16* | 0.29* | 1    |      |      |      |      |      |      |
| 5. Commonwealth country | −0.25* | 0.00 | 0.00 | −0.16* | 1    |      |      |      |      |      |
| 6. Gross domestic product per capita (ln) | 0.79* | 0.28* | 0.21* | 0.48* | −0.09* | 1    |      |      |      |      |
| 7. Population (log) | 0.05* | 0.08* | 0.31* | 0.20* | −0.23* | −0.06* | 1    |      |      |      |
| 8. Existence of road safety NGOs | 0.27* | −0.01 | 0.41* | 0.23* | −0.1* | 0.18* | 0.44* | 1    |      |      |
| 9. Political violence (ln) | −0.20* | −0.08* | −0.07* | −0.15* | −0.03 | −0.21* | 0.28* | −0.07* | 1    |      |
| 10. Road safety agency | 0.20* | 0.39* | 0.20* | 0.31* | 0.07* | 0.34* | 0.22* | 0.19* | −0.13* | 1    |

*Significant at 5%.
increase of this policy. In Latin American and the Caribbean, countries with formal ties to the Commonwealth were more likely to enact this measure.

Three limitations of the current study should be mentioned. First, there is considerable variation in the regulations defining what technical conditions child restraints must follow and thus our analysis should be taken with caution because the operationalization of ChRLs conflates restrictive with more flexible laws. Second, because this analysis considers only cases in which a policy was first introduced, subsequent ChRL reforms are not considered. This is important because international efforts such as the United Nations’ 1958 Vehicle Agreement and the global road safety campaign may have had an effect on these subsequent changes. Finally, because high traffic fatality rates could have been associated with the adoption of ChRLs, this variable should have been introduced. Nevertheless, because we controlled for population, GDP per capita, and urbanization these could be taken as proxies for traffic fatality rates.

There are 3 elements that need to be considered further in order to understand these results. First, the global road safety campaign promoted a whole range of measures, such as mandatory helmet use, seat belt use for drivers and passengers, stricter regulation of blood alcohol concentration legal limits, changes in vehicle safety standards, and improvement of road infrastructures, among many others. As a result, governments were probably made aware of the urgency of introducing a whole range of policies to tackle road crashes and their consequences. But ChRLs may have received the most immediate

Table 3. Hazard ratios of global adoption of ChRLs for the period 1974–2013 adjusting for global, regional, and national factors

|                      | (Model 1)       | (Model 2)       |
|----------------------|-----------------|-----------------|
| Control              |                 |                 |
| Urbanization         | 1.002 (0.25)    | 0.997 (–0.26)   |
| Global factors       |                 |                 |
| The road safety global campaign | 2.253** (2.70) | 1.992** (2.66) |
| Geneva Convention on Road Traffic | 1.821*** (2.04) | 1.474 (1.23)    |
| United Nations’ 1958 Vehicle Agreement | 3.592* (3.97) | 2.970* (3.61)   |
| Regional factors     |                 |                 |
| Commonwealth country | 1.215 (1.46)    | 1.033 (0.07)    |
| National factors     |                 |                 |
| Gross domestic product per capita (ln) | 1.889* (4.57) | 1.897** (4.45) |
| Population (ln)      | 1.041 (0.29)    | 0.956 (–0.38)   |
| Existence of road safety NGOs | 0.706 (–0.80) | 0.824 (–0.35)   |
| Explanatory variables|                 |                 |
| Political violence (ln) | —              | 0.576 (–0.96)   |
| Time (ρ)             | 1.577** (2.73)  | 1.425*** (2.47) |
| Number of countries  | 170             | 137             |
| Number of adoptions  | 69              | 59              |
| Observations         | 5,166           | 4,171           |
| Wald’s χ²            | 367.56†         | 870.31†         |
| Log likelihood       | −82.647         | −67.737         |
| df                   | 8               | 10              |

*Estimators are hazard ratios. Absolute values of z statistics in parentheses. All models adjusted for clustering at the region level.

Significant at 0.1%. **Significant at 1%. ***Significant at 5%.

Table 4. Hazard ratios of regional adoption of ChRLs for the period 1974–2013 adjusting for global, regional, and national factors

|                      | Africa (Model 3) | Asia (Model 4) | Europe and North America (Model 5) | Latin America and the Caribbean (Model 6) | Commonwealth (Model 7) |
|----------------------|-----------------|----------------|------------------------------------|------------------------------------------|------------------------|
| Controls             |                 |                |                                    |                                          |                        |
| Urbanization         | 1.043 (0.99)    | 0.960** (–2.83)| 0.995 (–0.27)                      | 1.062 (1.44)                            | 1.205 (1.42)           |
| Global factors       |                 |                |                                    |                                          |                        |
| The road safety global campaign | 3.359*** (2.28) | 1.814 (0.42)   | 1.411 (0.84)                      | 0.089* (–2.40)                           | 1.385 (0.40)           |
| Geneva Convention on Road Traffic | 0.732 (–0.29) | 9.616* (2.21)  | 0.626 (–0.96)                      | 1.192 (0.26)                            | 1.906 (0.95)           |
| United Nations’ 1958 Vehicle Agreement | −0.000* (–11.49)| 3.722 (1.63)  | 0.627 (–1.30)                      | —                                       | 0.539 (–0.58)         |
| Regional factors     |                 |                |                                    |                                          |                        |
| Commonwealth country | 0.775 (–0.27)   | 0.383 (–1.19)  | 1.415 (0.33)                      | 656.528 (1.85)                         | —                      |
| Creation of the European Transport Safety Council | — | — | 2.217* (2.18) | — | — |
| National factors     |                 |                |                                    |                                          |                        |
| Gross domestic product per capita (ln) | 1.163 (0.21) | 3.047| 2.414* (7.35) | 0.356** (–3.09) | 1.944 (1.29) |
| Population (ln)      | 1.261 (0.55)    | 0.684 (–0.71)  | 0.770 (–1.24)                      | 1.306 (0.71)                           | 0.986 (–0.07)          |
| Existence of road safety NGOs | 0.280*** (–2.39) | 7,810,940* (5.71) | 1.587 (0.31) | 3.085 (1.39) | 0.732 (–0.52) |
| Political violence (ln) | — | — | 9.833 (1.57) | 1.503 (0.29) | 0.574 (–0.88) |
| Road safety agency   | 5.297 (1.25)    | 2.230 (0.44)   | 2.542** (2.10)                     | 0.985 (0.23)                           | 3.974† (1.90)          |
| Time (ρ)             | 1.777 (0.66)    | 2.306 (1.92)   | 1.807** (3.07)                     | 21.792* (13.55)                       | 0.976 (–0.05)          |
| Number of countries  | 41              | 37             | 35                                 | 23                                       | 32                     |
| Number of adoptions  | 7               | 7              | 32                                 | 11                                       | 12                     |
| Observations         | 1,496           | 1,180          | 609                                | 880                                      | 1,069                  |
| Log likelihood       | −10.562         | −4.296         | −12.086                            | 3.620                                    | −14.086                |

*Estimators are hazard ratios and absolute values of z statistics in parentheses. All models adjusted for clustering at the region level.

Significant at 0.1%. **Significant at 1%. ***Significant at 5%. |Significant at 10%.
Global Diffusion of Child Restraint Laws

attention because there is almost universal agreement on the importance of respecting and protecting children's rights and safety. For example, the UN Convention on the Rights of the Child has been ratified by 195 countries (UN 2014c), and 97% of these countries ratified this convention no more than 4 years after it went into force in 1990. The effectiveness of the global traffic safety campaign required the support of several international and national actors, who jointly promoted road safety measures by disseminating information in international forums, contacting national governments directly, and publishing and distributing policy papers. Furthermore, the WHO and the WB relied on more than 30 years of research produced by the road safety academic community in order to choose the road safety measures that were promoted in this global campaign. In other words, this campaign was successful in translating very advanced knowledge to policy-makers.

Second, though global analyses present an interesting picture of this policy diffusion across the world, we also notice different tendencies within regions. It is evident that Asian and European and North American countries tend to be both innovators and early adopters, because the signing of the Geneva Convention of Road Traffic and the foundation of the European Transport Safety Council occurred before the year 2004, and this may explain the ChRL adoption rate of these 2 groups of countries as well. In regards to Africa, 2 unexpected findings deserve closer consideration. Both signature of the United Nations' 1958 Vehicle Agreement and the presence of a road safety NGO delayed the enactment of ChRLs. We suggest 2 complementary hypotheses to make sense of these results. First, signatory countries may have faced important challenges in both adopting and adapting the regulations. Child restraint devices must follow sophisticated and strict regulations. As such, these regulations require expertise that may not be readily available in these countries. So when some African countries signed this agreement, they faced challenges in finding adequate resources to adapt this international agreement to national legislation and conditions. On the other hand, NGOs in Africa may function as watchdog institutions. So when certain ChRL drafts were debated, these NGOs may have dismissed the drafts as technically inadequate because they did not meet some international standards. As a consequence, this may have unintentionally ended up deferring the enactment of these laws. In regards to Latin America and the Caribbean, it appears that the global road safety campaign delayed the enactment of these laws. Similar to the African countries, countries in this region may have faced challenges in adopting and adapting these regulations after the campaign was initiated. This may then have produced a considerable postponement in the enactment of this measure. Given the results for Africa and Latin America and the Caribbean, it might be advisable to consider the creation of regional road safety councils, as was done in Europe, as well as national road safety agencies, because both types of organizations can connect academic efforts to governmental work on a permanent basis.

Lastly, though global and regional factors matter, there are also national conditions that are associated with the adoption of this policy. Both GDP per capita and the presence of road safety agencies are associated with ChRLs. More particularly, countries with greater resources may adopt ChRL because they have the capacity to introduce appropriate enforcement programs to monitor the implementation of the stipulated norms; in addition, their populations have the means to buy these devices and thus can easily adapt to these legal demands. Similarly, the existence of road safety agencies is associated with the promotion of different road safety measures that these organizations can carry out within their respective countries.

To conclude, the current study is one of the few to comprehensively quantify the effects of global, regional, and national factors on road safety policy adoption. More particularly, this study examined how the policy adoption pattern across the world is associated with the global road safety campaign of the WB and the WHO, as well as with other relevant international, regional, and national forces. It also contributes to understanding road safety adoption processes, a particularly timely contribution given that traffic fatalities are one of the world's leading causes of death. At the very least, our findings suggest that more effective diffusion of road safety measures across lagging regions can be achieved by sustained global efforts and the creation of road safety regional and national organizations.

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Supplemental Materials

Supplemental data for this article can be accessed on the publisher's website.

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