# School entry cutoff and the timing of births: evidence from Argentina

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## Abstract

The distance between the date of birth and the school entry cutoff has been repeatedly used as an exogenous instrument to examine the impact of several educational programs. In this work we analyze the validity of this instrument for the case of Argentina. From a regression analysis, considering multiple waves of the Permanent Household Survey, we detect the existence of discontinuities in the distribution of births around the school entry cutoff (June 30). This suggests that parents act strategically. In particular, these defer the date of birth to days after the cutoff. This result is especially robust when considering a bandwidth of 7 days before and after the cutoff and in men, but not in women. The findings suggest a careful consideration of estimates that assume that the birth distribution is exogenous to the school entry cutoff.

**Key-words**: school entry cutoff, timing of births, strategic behavior, Argentina

## 1. Introduction

The economics of education literature has repeatedly used the distance between the date of birth and the school entry cutoff as an exogenous instrument to study the impact of several educational programs (Cascio, 2007; McEwan and Shapiro, 2008; Dobkin and Ferreira, 2009; Berlinski, Galiani and McEwan, 2011; Fredriksson and Ockert, 2013; Chen, 2015; Cook and Kang, 2016; Depew and Eren, 2016; Tan, 2017; Zhang et al., 2017; Landersø et al., 2017). These estimates require that the distribution of births around the cutoff be exogenous to the cutoff itself. The existence of discontinuities in this interval, as a result of the manipulation of the date of births, would affect the validity of the estimates by violating the assumption of exogeneity (McCrary, 2008; Huang, Zhang and Zhao, 2020).

The manipulation of the date of birth can respond to a strategic behavior of parents. If they believe that older children have a better educational performance, they could defer birth to days after the school entry cutoff and, consequently, their children's school entry. That is, parents who value the potential long-term educational benefits above the cost of an extra year of home care will prefer a deferred school entry (Shigeoka, 2015). On the other hand, if parents believe that early schooling results in better performance, they will want to advance birth and school entry.

The education literature has shown mixed results regarding the relationship between the age at school entry and educational performance. In an extensive review of the literature, Stipek (2002) reports that older children present a modest academic advantage, relative to their younger peers, in the first years of schooling but that the differences disappear later. When comparing 19 OECD countries, Bedard and Dhuey (2006) find that the youngest children in each cohort perform worse on standardized tests and that the differences persist in the long term. Similar results are reported in McEwan and Shapiro (2008) and Cáceres-Delpiano and Giolito (2018) for Chile, in Elder and Lubotsky (2009) for the United States and in Crawford, Dearden and Meghir (2007) for England. This result can be explained from the fact that those children who enter the school system at an older age have a greater cognitive, physical and emotional maturity that leads to better outcomes (Thompson, Barnsley and Battle, 2004; Depew and Eren, 2016). On this point there is an open debate about which part of the differences are due to different learning speeds and which to differences in the knowledge stocks. If the latter were the source of most of the observed differences, these are expected to disappear after the first few years as the initial stock of knowledge becomes less important (Elder and Lubotsky, 2009).

On the contrary, a large group of works reports that early schooling results in better academic performance. Angrist and Krueger (1991) and Mayer and Knutson (1999) analyze the case of the United States and report that children who enter school at an earlier age obtain higher educational attainment (completed years of study) and higher salaries. In addition, empirical evidence has also suggested that early schooling may lead to better results on standardized tests or school progression (Chen, 2015; Zhang et al., 2017; Tan, 2017). In this regard, the economics literature has repeatedly pointed out the potential benefits of early schooling (Cunha et al., 2006; Heckman, 2006; Almond and Currie, 2011; Dip and Gamboa, 2019). Even without considering the returns to education, early schooling is optimal since at this stage the opportunity cost for children is minimal (Becker, 1993).

In this context, in this work we evaluate the validity of the assumption of exogeneity of the timing of births in relation to the school entry cutoff for the case of Argentina. Using microdata from the Permanent Household Survey (EPH), elaborated by the National Institute of Statistics and Censuses (INDEC), we examine the distribution of births between the days before and after the school entry cutoff (June 30). The results suggest the existence of discontinuities in the distribution of births. Parents of boys born in the last two decades act strategically by deferring the birth to days after the cutoff. Consistent with recent evidence, the parents of these children are willing to endure an additional year of home care in exchange for better future academic performance. The result is particularly robust when considering a bandwidth of 7 days before and after the cutoff, and disappears when considering bandwidths greater than 21 days. These findings suggest that strategic behavior refers to the date of birth, but not to conception.

This work is related to that literature interested in examining the effects of the age at school entry on educational outcomes (Moyi, 2010; Chen, 2015; Seshie-Nasser and Oduro, 2016). In broader terms, it is related to the literature that analyzes the effects of economic incentives on the timing of births (Schulkind and Shapiro, 2014; Borra, González and Sevilla, 2016; Jürges, 2017). The added value of this work lies in two aspects. First, it provides novel evidence in favor of the idea of manipulation in the timing of births around the school entry cutoff and, therefore, against the assumption of exogeneity of the distance of births to the cutoff. Together with the proposals by Huang, Zhang and Zhao (2020), for a Chinese province, and Shigeoka (2015), for Japan, this work is one of the few antecedents that reports signs of manipulation of the timing of births. Second, it provides evidence regarding which population subgroups are most likely to present manipulation at birth.

From now on, section 2 describes the peculiarities of school system in Argentina. Section 3 presents the main source of information used, while section 4 describes the identification methodology in detail. Section 5 presents the results and, finally, section 6 discusses the main conclusions of the work.

## 2. School entry in Argentina

Almost every country in the world sets a minimum age as well as a cutoff date for school entry. Each child must be of the minimum age required upon reaching this cutoff. In the case of Argentina, this cutoff was set at June 30 of each year. Thus, those who start primary education must be 6 years old by June 30 of the starting year. This implies that children born just a few days apart (before and after June 30) start their education in different years. Unlike other countries, such as the United States, the cutoff for school entry is the same in all Argentine provinces.

Argentina is a middle-income country with a long tradition of free public education. In particular, primary education has been compulsory since 1885. Secondary education has been compulsory since 2006. Despite this obligation, no sanctions are established for noncompliants.

At present, Argentina has high enrollment rates. In terms of primary schooling (99%), the country ranks third in the American continent behind Mexico and Cuba (UNESCO, 2012). At the secondary level, schooling is lower (Table 1). Similarly, the effective promotion and dropout rates seem more encouraging for the primary level. This implies that, in Argentina, the compulsory nature of primary education has made it universal today, but the same does not seem to be true for secondary education.

Table 1: Indicators of the educational system in Argentina

| Indicator | Media |
|---|---|
| Primary schooling 2001 | 98.2 |
| Primary schooling 2010 | 99 |

| | |
|---|---|
| Secondary schooling 2001 | 87.4 |
| Secondary schooling 2010 | 89 |
| Illiteracy rate 2010 | 1.9 |
| Primary schooling effective promotion rate 2010 | 94.5 |
| Secondary schooling effective promotion rate 2010 | 78 |
| Primary schooling interannual dropout rate 2010 | 1.3 |
| Secondary schooling interannual dropout rate 2010 | 12.74 |

Source: own elaboration based on INDEC (2010)

**3. Sources of information**

This work uses the microdata from the Permanent Household Survey (EPH) elaborated by the National Institute of Statistics and Censuses (INDEC) on a quarterly basis for 31 urban agglomerates in the country. The agglomerates surveyed in the EPH are: Posadas (Misiones), Gran Resistencia (Chaco), Corrientes and Formosa in the Northeast region (NEA). For the Northwest region (NOA), Santiago del Estero-La Banda, Jujuy-Palpalá, Gran Catamarca, Salta, La Rioja and Gran Tucumán-Tafí Viejo are surveyed. The Central region includes Gran Córdoba, Rio Cuarto, Gran Santa Fe, Gran Rosario, Gran Paraná, Concordia, Bahía Blanca-Cerri, Gran La Plata, Mar del Plata-Batán and San Nicolás-Villa Constitución. In the southern region (Patagonia), Rawson-Trelew, Comodoro Rivadavia-Rada Tilly, Río Gallegos, Santa Rosa-Toay, Ushuaia-Rio Grande, and Viedma-Carmen de Patagones are surveyed. Greater Buenos Aires includes the City of Buenos Aires and the Buenos Aires bordering districts. The Cuyo region concentrates Greater Mendoza, Greater San Juan and Greater San Luis.

Although the current continuous modality of the EPH (quarterly frequency and in multiple urban agglomerates) dates back to 2003, only since 2016 the survey reports information referring to the date of birth of each person surveyed. Therefore, in this work the waves of the survey carried out in the years 2016, 2017, 2018, 2019 and 2020 are used.

Table 2, below, presents basic descriptive statistics of people born before and after the Argentine school entry cutoff and surveyed in the EPH. It is observed that those born between June and July and surveyed in the EPH add up to almost 70,000 people. Furthermore, the sample for both months is balanced.

Table 2: Descriptive statistics for those born in June and July, waves 2016 to 2020

| Indicator | Born in June | Born in July | Mean difference |
|---|---|---|---|
| Women | .5189 | .5180 | .0009 |
| NEA | .1204 | .1185 | .0019 |
| NOA | .2191 | .2202 | -.0011 |
| Cuyo | .0954 | .0957 | -.0003 |
| Center | .2806 | .2828 | -.0022 |

| | | | |
|---|---|---|---|
| GBA | .1600 | .1561 | .0039 |
| Patagonia | .1246 | .1268 | -.0022 |
| 0-20 years | .3339 | .3370 | -.0031 |
| 21-40 years | .3048 | .2934 | .0114* |
| 41-60 years | .2158 | .2138 | .002 |
| +60 years | .1454 | .1558 | -.0104* |
| Half of higher-income | .1631 | .1648 | -.0017 |
| Births | 33,377 | 34,428 | |

Source: own elaboration based on EPH-INDEC

Note: each row refers to the proportion of births of that population subgroup registered in each month. * significant at 5%, ** significant at 1%, *** significant at 0.1%.

**4. Methodology**

The identification strategy of this work exploits the potential discontinuity around the school entry cutoff. Thus, equation 1 is estimated for those born just days before and after this cutoff (June 30):

$$Births_d = \alpha + \beta Before_d + \rho_d + \delta_d + \mu_d \qquad (1)$$

where $Births_d$ is the number of births registered on day $d$; $Before_d$ is a dummy variable that takes value 1 if the birth was registered before June 30; $\rho_d$ and $\delta_d$ are fixed effects by day of the week and holidays, respectively; $\mu_d$ is the model error term. β is the coefficient of interest. If this coefficient is positive, it indicates that the parents strategically alter the time of birth and advance the delivery. On the contrary, a negative β suggests that the parents delay the delivery.

Equation 1 is estimated considering a period of 7 days before and 7 days after the cutoff. Alternatively, this bandwidth is extended by including 14, 21 and 28 days before and after. It is expected that, if any, the effect will be greater the greater the proximity to the cutoff. The existence of heterogeneous effects between households is also examined by separating the sample by sex, region, and birth cohorts.

The estimates arise from considering a pooled regression of the waves 2020 (first semester), 2019, 2018, 2017 and 2016 of the EPH. Although this source of information was already elaborated before 2016, it is only in this year that the survey incorporated the day of birth of each respondent since its continuous modality was implemented in 2003. Prior to 2003, the EPH, in its punctual modality, was surveyed only twice a year and in a smaller number of urban agglomerates.

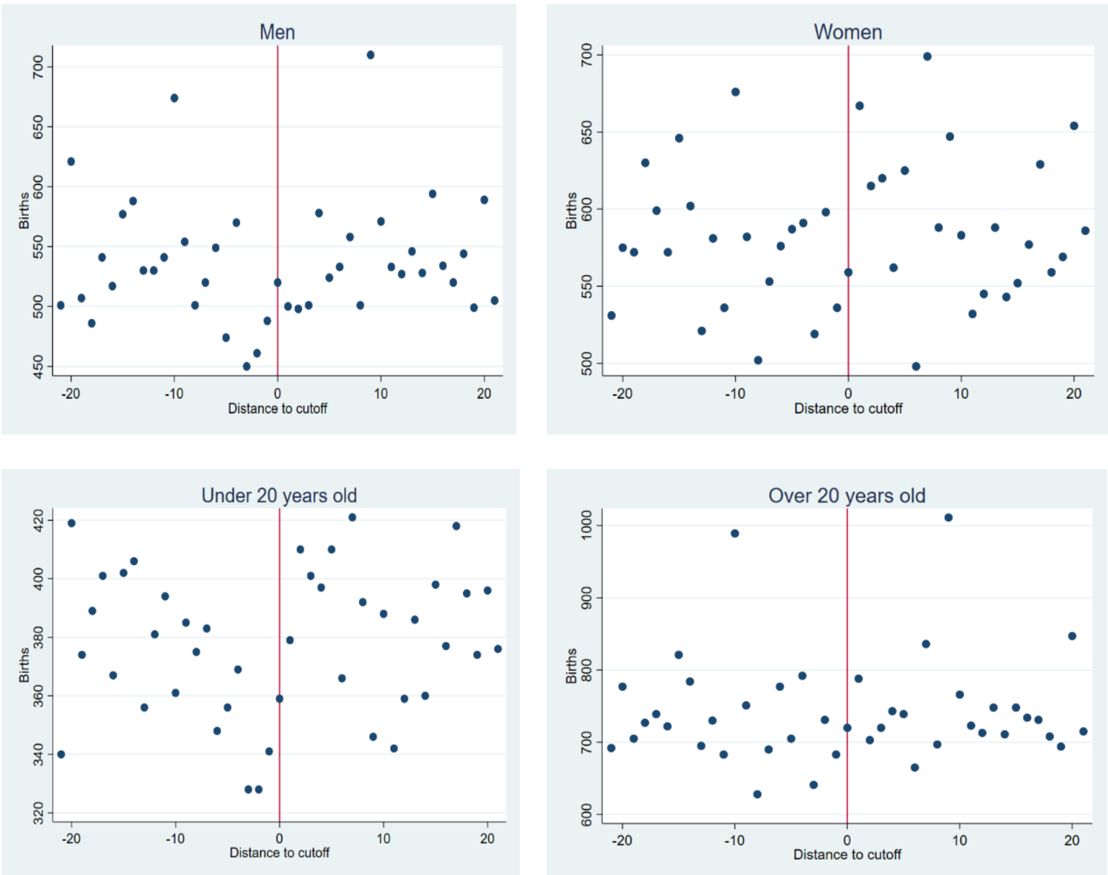
In order to strengthen the credibility of the results, the potential existence of a "beginning of the month" effect is explored whereby parents systematically postpone births from the last days of each month to the first of the next one. This effect could be confused with that of the school entry cutoff. To rule out this possibility, equation 1 is re-estimated for all the remaining months of the year, comparing between those born in the last week of each month and the first of the next one.

No significant differences are expected to be found in this case. Also, the McCrary density test (McCrary, 2008) is implemented to test the existence of a discontinuity at the school entry cutoff.

Although the estimation strategy controls for unobserved heterogeneity between days of the week and holidays, it is not without limitations. In particular, given the source of information used here (sample of urban households), it is necessary to include multiple-year births to achieve an adequate number of observations. This results in the impossibility of including fixed effects by year of birth, given the number of days considered in the estimates of equation 1 (each day is an observation).

Before proceeding to the results section, below, Figure 1 presents the daily distribution of births around the school entry cutoff for different population subgroups. The upper panel shows the distribution of births by sex, while the lower panel shows it for two age subgroups. It can be visualized that the number of births falls in the days before the threshold, and then increases, in the cases of births of men and of the youngest cohorts (up to 20 years at the time of the survey). This is especially true when looking at the 7 days before and after the cutoff. This suggests, a priori, the existence of a discontinuity for these subgroups in the timing of births. No differences are observed in the case of births of women or of older cohorts.

Figure 1: Daily distribution of births and school entry cutoff in Argentina



Source: own elaboration based on EPH-INDEC

Note: each point is the daily number of births. The days were standardized by their distance from the school entry cutoff (June 30 equal to 0).

**5. Results**

Table 3 presents the results that arise from estimating equation 1 for different bandwidths around the school entry cutoff. It is observed that during the last week of June there are significantly fewer births. This suggests that households act strategically by deferring birth to the week after the school entry cutoff (June 30). The result is reduced, in absolute value and significance, by progressively expanding the bandwidth (14, 21 and 28 days). Thus, for a time window greater than 21 days, there are no significant differences.

The previous result is especially relevant because it suggests that the strategic behavior of parents is reduced to the choice of the moment of birth, but not of conception. Thus, parents seem to delay the moment of birth by a few days, while no significant differences appear for longer periods (months). This is reasonable considering that in Argentina the caesarean section rate amounts to 34.7% (Ministerio de Salud y Desarrollo Social de la Nación, 2018).

Table 3: School entry cutoff and timing of births in Argentina

| | 7 days before | 14 days before | 21 days before | 28 days before |
|---|---|---|---|---|
| Born before | -118.12*** | -79.28** | -42.44* | -28.32 |
| | (22.24) | (23.43) | (20.07) | (19.91) |
| Fixed effects by day of the week | Yes | Yes | Yes | Yes |
| Fixed effects by holidays | Yes | Yes | Yes | Yes |
| N | 14 | 28 | 42 | 56 |
| $R^2$ | 0.8889 | 0.5404 | 0.3931 | 0.3254 |

Source: own elaboration based on EPH-INDEC.

Note: * significant at 5%, ** significant at 1%. *** significant at 0.1%. Robust errors in parentheses.

Table 4 explores the existence of heterogeneous effects between population subgroups. It is observed that deferral at birth operates for males, but not for females. In regional terms there are also differences with Cuyo and Patagonia with significant effects. The differences by sex are consistent with that reported by Shigeoka (2015).

Table 4: Heterogeneous effects around the school entry cutoff in Argentina

| | Men | Women | GBA | NOA | NEA | Cuyo | Center | Patagonia |
|---|---|---|---|---|---|---|---|---|
| Born before | -47.84* | -50.55 | -3.8 | -21.81 | -8.71 | -22.73** | -14.94 | -22.57* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (15.56) | (22.90) | (9.14) | (11.10) | (15.14) | (6.16) | (7.56) | (9.36) |
| Fixed effects by day of the week | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fixed effects by holidays | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| $R^2$ | 0.6356 | 0.7641 | 0.5063 | 0.5930 | 0.5546 | 0.7470 | 0.8947 | 0.6194 |

Source: own elaboration based on EPH-INDEC.

Note: * significant at 5%, ** significant at 1%. *** significant at 0.1%. Robust errors in parentheses. Men include only male births, while Women include only female births. The regions considered are: Greater Buenos Aires (GBA), Northwest (NOA), Northeast (NEA), Cuyo, Center and Patagonia.

The existence of heterogeneous effects can also be observed when comparing between birth cohorts. Table 5 shows that the youngest cohorts (up to 20 years old) are those for which a significant delay arises at birth. This suggests that, at present, parents show greater interest in the academic performance of their children and therefore the distribution of births is no longer exogenous to the school entry cutoff. This, in turn, may respond to the higher returns to education today or to the fact that schooling has become more frequent.

Table 5: Heterogeneous effects between birth cohorts in Argentina

| | 0-20 years old | 21-40 years old | 41-60 years old | 61 or more |
|---|---|---|---|---|
| Born before | -56*** | -20.33 | -9.83 | 3.03 |
| | (8.16) | (22.72) | (13.89) | (10.39) |
| Fixed effects by day of the week | Yes | Yes | Yes | Yes |
| Fixed effects by holidays | Yes | Yes | Yes | Yes |
| N | 14 | 14 | 14 | 14 |
| $R^2$ | 0.8900 | 0.6728 | 0.3211 | 0.6407 |

Source: own elaboration based on EPH-INDEC.

Note: * significant at 5%, ** significant at 1%. *** significant at 0.1%. Robust errors in parentheses.

Table A.1 in the Annex provides an additional robustness check. There it is shown that the existence of a “beginning of the month” effect is not verified when considering the remaining months of the year. Indeed, when comparing those born 7 days before and after each end of the month, except June, no significant differences emerge. Table A.2 presents the results corresponding to the McCrary density test. It is verified the existence of a discontinuity at the school entry cutoff. Thus, the estimator is positive and significant, which suggests that more births take place after the cutoff.

The results of this work are consistent with recent evidence regarding the existence of discontinuities around the school entry cutoff (Shigeoka, 2015; Huang, Zhang and Zhao, 2020). For the case of Japan, Shigeoka (2015) suggests that parents prefer to delay their children's school entry, given the belief that older children obtain better academic results -which can persist in the long term-, even having to endure an additional year of home care. For the Argentine case, this implies that parents of boys and of the most recent cohorts defer the date of birth to days after the school entry cutoff, expecting a better school performance from their children.

The existence of heterogeneous effects suggests considering with caution those estimates that assume that the distribution of births around the school entry cutoff is exogenous to the cutoff itself. This is consistent with the existence of a discontinuity around this cutoff and which would violate one of the basic assumptions of regression discontinuity designs (McCrary, 2008).

The findings reported here seem, a priori, contradictory with those reported in Berlinski, Galiani and McEwan (2011) for the Argentine case. However, the differences can be explained by multiple reasons. First, these authors consider a bandwidth of 3 months before and after the school entry cutoff and find no significant differences. Accordingly, our results suggest that the differences disappear for periods longer than 21 days. Second, Berlinski, Galiani, and McEwan (2011) use administrative birth records. This source considers births from all types of localities (urban, rural, small towns, etc.) while the EPH only collects information from large urban agglomerates. Third, Berlinski, Galiani and McEwan (2011) consider births registered between 2002-2005. In other words, they do not include most of the most recent cohorts for which our work reports significant differences. Thus, the differences in bandwidth and in geographical and temporal coverage may explain the disparate conclusions of both studies.

## 6. Conclusions

Throughout this work we have examined the assumption of exogeneity of the distribution of births around the school entry cutoff for the case of Argentina. The results show that this distribution presents discontinuities and, in effect, is not exogenous to the school entry cutoff. This is especially robust for a bandwidth of up to 7 days before and after the cutoff and for specific population subgroups: thus, in the cases of males, but not females, the parents defer the birth to moments after the cutoff. The same is true for those born in more recent years.

The findings reported here have implications for the economics of education literature. First, an identification strategy that uses distance from birth to school entry cutoff as an exogenous instrument may be invalid. That is, given that parents strategically defer the date of births, and that this behavior is heterogeneous between subgroups, a key assumption of regression discontinuity designs is violated (McCrary, 2008).

Second, the gender dimension appears as relevant in the analysis. As our findings suggest, parents defer the birth of their male children, but not female ones. This could be due to a greater interest in men's education and, ultimately, a greater willingness to invest in their schooling. This raises a new question: what proportion of the differences observed in academic performance between men and women is due to differences in investment in education received by each group. Indeed, even if women showed better performance on standardized tests, the difference with respect to men would be greater if investment in education were equitable.

In the future, the results of this work can be extended in multiple directions. First, the availability of administrative birth records appears necessary to have representative results for all types of localities and not only for large urban agglomerates (such as those included in the Permanent Household Survey used here). Second, the existence of significant differences on the timing of births, only for the youngest cohorts (up to 20 years old at the time of the survey) suggests that it is only in the medium term that it will be possible to assess whether they present differences in dimensions of well-being (i.e. education, income, among others) when comparing those born before and after the school entry cutoff. For this to be possible, it is essential that the EPH microdata continue to report the day of birth in a consistent format.

**Annex**

Table A.1: Robustness to the "beginning of the month" effect

| | 7 days before and after in other months |
|---|---|
| Born before | -124.50 |
| | (67.67) |
| Fixed effects by day of the week | Yes |
| Fixed effects by holidays | Yes |
| N | 154 |
| $R^2$ | 0.1601 |

Source: own elaboration based on EPH-INDEC

Note: * significant at 5%, ** significant at 1%. *** significant at 0.1%. Robust errors in parentheses. Those born 7 days before and after each end of the month, except for June, are included.

Table A.2: McCrary density test and the school entry cutoff

| | |
|---|---|
| Log discontinuity estimate | .091065356*** |
| | (.035999758) |

| | |
|---|---|
| Iterations | 366 |
| Bandwidth | 7 |

Source: own elaboration based on EPH-INDEC

Note: * significant at 5%, ** significant at 1%. *** significant at 0.1%. Standard errors in parentheses. See McCrary (2008) for a detail explanation.

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