EC386: Introduction to Health Economics and Policy

A Critical Review of:

Long-run economic impact of in-utero shocks

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Contents

Introduction：

This paper focuses on describing the future long-term economic impact on this group of individuals due to the trauma caused by fasting during Ramadan on the infant in utero during pregnancy. Because there is limited previous evidence on the long-term impact of labour markets on affected individuals and underlying mechanisms (Mahanani et al., 2021), this paper chooses to look at the future taxation of children born to this group of mothers by collecting administrative tax data and selecting mothers who fasted during pregnancy as the target vehicle for the study. The future tax situation of children born to these mothers was analysed and studied.

Cejka & Waseem (2022) found that economic income and occupational choice negatively correlated with early health and educational outcomes. The relevance of the article's experiment using a large amount of quantitative data as a sample is significant. However, there is also a need for more rigour in the design and conduct of the experiment.

This critical reading will analyse and evaluate these arguments and propose a more rational and scientific alternative test to demonstrate more clearly the long-term economic impact of fasting factors on the health and education of affected individuals. It also calls for greater attention to the potential effects of in-utero trauma on the future development of the foetus and the long-term economy.

Description of Arguments：

Cejka & Waseem (2022) look at the labour market situation of both groups after work and find that educational attainment and physical health affect economic earnings. The two variables of education and health status are influenced by the fact that the sample was in the womb during Ramadan fasting and minor shocks.

Therefore, Cejka & Waseem (2022) can indirectly infer objectively the impact of whether the mothers of the sample group fasted during Ramadan on the future economic income of the sample group through the tax status of the sample group.

The following is a distillation and discussion of several important concluding sections.

The important role that in-utero trauma and nutritional deprivation play in the development of the individuals in the sample:

Nutritional deprivation during the nine months of pregnancy and the instability of the external environment are crucial to the future development of the foetus. Minor trauma during pregnancy has longer-term effects and potential problems for the child's health (Almond & Currie 2010, 2011). The increased psychological issues and stress of pregnant women during two years (1944-1945) due to lack of food and an unstable social order (high frequency of homicides) had negative consequences for the future health and economy of the affected foetus (Scholte et al., 2015; Conti et al. 2021, 2022, Koppensteiner & Manacorda, 2016).

Ramadan fasting during pregnancy can harm the health status and educational attainment of the foetus both at birth and in the future:

Fasting during Ramadan is an important pillar part of Islam and involves affecting a very large number of pregnant women groups. Understood realistically, the trauma suffered by the foetus in the womb is difficult to observe. Ramadan fasting is an exogenous shock, and as a traditional culture in Islam, people of different socio-economic statuses are required to perform Ramadan fasting. Ramadan fasting can be considered an exogenous trauma during pregnancy. Cejka & Waseem (2022) explored the role of pregnancy shocks in influencing the economic development of individuals in adulthood from the perspective of Ramadan fasting as an exogenous trauma.

During Ramadan, the lack of nutrient supply in the body due to reduced food intake, reduced sleep duration and fasting-induced stress in pregnant women can harm the future development of individuals in the Ramadan-exposed sample, most notably in the form of lower birth weight of the foetus. (Almond, 2009; Almond & Mazumder, 2011)

Also, regarding educational attainment, maternal fasting while the foetus is in the womb leads to a general reduction in the future educational attainment of the sample individuals and a lower performance in skill acquisition than those whose mothers did not fast during pregnancy. (Almond et al., 2014; Majid, 2015)

Health factors in later life for individuals exposed to Ramadan fasting in utero are also an important indicator of the long-term development of the sample individuals from

fasting and fasting, which according to Almond et al., showed that affected individuals showed an overall trend of deteriorating health status (Almond, 2009; Almond & Mazumder, 2011; Van Ewijk, 2011).

Research methods:

Cejka & Waseem (2022) used Pakistani administrative tax data to analyse and compare the economic income as well as occupational choices of a sample of individuals as adults. Income tax returns for 2007-2009 were used to obtain information on people's date of birth, educational background, financial income and occupation.

The sample covered people born in the 66 years from 1924 to 1989, and the data were categorised into 'Ramadan exposed' and 'Ramadan non-exposed according to the month of birth. The financial data were compared and analysed after controlling for factors such as parental status, region of birth, the season of pregnancy, sex ratio and choice of time of conception.

Results of the experiment:

Undergoing Ramadan fasting during pregnancy had long-term and far-reaching effects on the future development of affected infant individuals. In terms of economic income, the study's results showed that individuals who experienced Ramadan fasting in the womb earned significantly less in adulthood than those who did not participate in Ramadan. In terms of occupational choices, meanwhile, individuals exposed during Ramadan were more inclined toward occupations in the retail sector and wholesale

trade, where skill levels were lower. Conversely, non-exposed individuals were more advantaged in industries that required specialist skills and high levels of education, such as finance and accounting.

As economic income is influenced by occupational choice and educational attainment, the difference in tax data reflects the difference in financial income status between the 'Ramadan exposed group' and the 'Ramadan unexposed group' over time. Also, according to Figure 1, which analyses the intrauterine Ramadan exposure and income data, the average income of affected fetuses exposed for 3-8 months is 2-3% less than that of unexposed individuals in the long term and is the most affected group.

Mechanisms of explanation:

In terms of mechanisms of action, Cejka & Waseem (2022) suggest that the negative effects of Ramadan exposure on earnings may be explained through two channels: the skills channel and the health channel.

In terms of the skills channel, Cejka & Waseem (2022) suggest that during pregnancy, mothers experience Ramadan fasting and environmental stress that can make children relatively less competent in cognitive and non-cognitive skills. In the future development of the affected individuals, this lower endowment of competencies can hinder the formation of skills in the developmental process, leading to a lower level of education and, consequently, a lower economic income for this affected sample of individuals.

In terms of the health channel, Cejka & Waseem (2022) confirm that fasting during Ramadan leads to lower health levels among children and that the low income of the Ramadan-exposed sample stems from their worse health status, resulting in this group of affected individuals performing less well in the labour market than the other group of individuals in the Ramadan-unexposed sample.

Assessment of Assumptions and Claims：

Strengths of the literature:

This article has several strengths in terms of topic selection, research methodology and sample selection. Firstly, in terms of topic, Cejka & Waseem (2022) chose the real-life context of 'Ramadan fasting' to explore the effects of exogenous trauma on the foetus in utero, providing a more visual and standardised picture of the impact of fasting during pregnancy on the future development and economic status of the foetus.

Secondly, regarding research methodology, Cejka & Waseem (2022) cleverly used quantitative data on personal income tax to conduct their analysis. The experimental data's more specific and large sample size made the results more objective and accurate. The sample compensates for the effects of sex ratio and season on individual development.

In terms of controlling for confounding variables in the sample, Cejka & Waseem (2022) focus on the effects of confounders, such as the month of pregnancy and fetal sex. In

control for fetal sex, the analysis of the data tables determined that Ramadan exposure was not associated with the proportion of fetuses of either sex. The standard errors of the coefficients are very small compared to the sample size, and the differences in sex ratios between the comparison groups are negligible, as illustrated in Table 1.

According to Cejka & Waseem (2022), the experimental analysis showed no difference in the choice of Ramadan fasting by parents of different economic levels and educational attainment, concluding that parental choice of Ramadan exposure was not predictive and that this approach largely controlled for variance in the variables.

Finally, the study also has very positive practical implications in helping people to become aware of the threat that participation in Ramadan fasting during pregnancy poses to the long-term economic development of the foetus in the womb in the future, thus raising awareness of the choice of Ramadan fasting during pregnancy among pregnant women.

Shortcomings of the literature:

Unreasonable relationship between experimental variables and causality of inferred outcomes:

Cejka & Waseem (2022) used the correlation between in-utero Ramadan exposure and income in adulthood to present a causal relationship. However, its validity is limited and incomplete. In this paper, Ramadan exposure in utero is inferred from the date of birth of the foetus in utero. The sample is divided into a 'Ramadan exposed group' and

a 'non-exposed group', with the conclusion relating the individual's future economic income directly to whether or not the sample was exposed in utero. In the conclusion section, the future financial gain of the individual is directly related to whether the model experienced fasting in utero.

Cejka & Waseem (2022) did not investigate individuals' intrauterine Ramadan exposure. However, he only used their date of birth to infer whether or not they experienced Ramadan in utero and for how long, which is an idealistic way of classifying individuals. Although the authors have controlled for confounding factors, several factors can influence the dependent variables of long-term economic and occupational choice, such as parental socioeconomic, regional development and cultural differences (Currie et al., 1999). In the present study, Cejka & Waseem (2022) did not control for these confounding factors, and the validity of their variable relationships has yet to be verified. Therefore, even if the correlation study were significant, it would not be possible to use Ramadan exposure while in utero in the sample population as the main influencing factor for differences in the economic income of the sample.

In terms of the sample, it was optional for pregnant women to participate in fasting during Ramadan and each individual's attitude towards fasting and the duration of fasting experienced varied (Mubeen et al., 2012). Another factor that greatly impacted the experiment's outcome was a normal pregnancy and preterm or overdue pregnancies. The reliance on the timing of normal pregnancy in this paper causes some potential measurement errors for most indicators of Ramadan exposure, as some pregnancies will

be delivered prematurely or beyond full term. In this paper, the idealised division of Ramadan exposure based on the date of birth does not consider the reality of pregnancy in real-life situations. This factor can have a confounding effect on the findings.

In summary, Cejka & Waseem (2022) identified the measure of whether the data sample group was exposed in utero during Ramadan as date of birth, which implies an intention-to-treat design was used. The reality is that it is impossible to determine whether the effect of the dependent variable is entirely due to the Ramadan fast itself or whether it is due to behavioural change or any other event strictly related to Ramadan. Suppose the date of birth is used as a criterion. In that case, some variability in the timing of pregnancy should be taken into account and further explored using refined cut-off date values (Van Ewijk, 2011).

Intention-to-treat designs can avoid confounding due to non-random factors and are more effective when conducting analyses of large population datasets. However, insufficient refinement in the sample classification can reduce the association's veracity (Pradella & Van Ewijk, 2018; Schoeps et al., 2018).

Diverse socioeconomic influences exist:

Socioeconomics has a moderating effect on endogenous intrauterine shocks. For intrauterine surprises, poorer populations are much more negatively affected than wealthier populations. Socioeconomic status (SES) is a significant positive predictor of individual health (Winkleby et al., 1992). This means that relatively wealthy households

may be affected by this trauma to a lesser extent than poorer households are affected by trauma due to economic factors. Even if the same Ramadan fasting harm is experienced, wealthy families may mitigate the negative effects of Ramadan exposure on children by compensating in other ways, such as nutritional supplements, energy compensation, etc. (Currie et al., 1999).

Based on the data in Table 2, it is easy to see that Cejka & Waseem (2022) did not directly measure the economic status of individual parents during their analysis but used the overall economic level of different regions as a measure of the parent's financial situation. This approach of using the birthplace of the sample as a proxy for individual household economic level is more one-sided. It does not accurately measure the actual effect of household economic level on an individual's long-term development.

Alternative possible tests:

To assess the validity of Cejka & Waseem's (2022) estimates of the long-term effects of in-utero Ramadan exposure, additional tests could be conducted in three areas: sample measurement, controlling for relevant confounding variables, and in-depth analysis of the underlying mechanisms.

In terms of sample measurement as well as study methodology, Cejka & Waseem's (2022) estimate has an intention-to-treat effect, and to reduce the limitations imposed by this estimate, an actual investigation of sample characteristics could be added. Already studies have highlighted that their study design allowed them to analyse

Ramadan exposure during pregnancy as a natural experiment, suggesting the possibility of causal inference (Kunto & Mandemakers, 2019; Majid, 2015; Schultz-Nielsen et al., 2016). Therefore, we can carry out relevant measurements in two ways. On the one hand, the control of Ramadan exposure can be strengthened by investigating individuals' actual intrauterine Ramadan exposure, whereby individuals are divided into 'Ramadan exposed' and 'non-exposed' groups. On the other hand, this study used cross-sectional data for analysis, which could be used in future long-term follow-up studies. A longitudinal follow-up study explored the causal relationship between Ramadan exposure during pregnancy and adult educational status, economic income, and occupational choice.

In terms of confounding variables, Cejka & Waseem (2022) considered several confounding factors such as gender, choice of pregnancy, and season of birth. However, the parents' socio-economic situation and the compensatory role of other resources during Ramadan are also worth considering for the fetus during pregnancy and its subsequent development (Almond & Mazumder, 2011; Currie et al., 1999). In addition, this paper uses data from a sample of Pakistan for the centralised study. To avoid the interference of regional factors, relevant data from other countries and regions could be added to the survey, for example, in the context of different income countries.

In terms of mechanisms of action, this paper attempts to explain the mechanisms of the effects of Ramadan exposure during pregnancy on long-term development in adulthood through both skills and this health channel. However, it does not investigate and analyse

health levels in depth. Therefore, a more targeted investigation of the health levels of the sample could be conducted, quantitative data analysed, and the influencing factors explored.

Conclusion：

In conclusion, Cejka & Waseem (2022) have discussed the significant negative effects of fasting and environmental shocks during pregnancy on the long-term economic impact of affected individuals in adulthood from the perspective of fasting and fasting on the health and future development of the fetus in the womb.

By comparing and analysing tax data and economic conditions in Pakistan, the experiment cites accurate tax data to laterally confirm that the negative effects of Ramadan exposure during pregnancy may translate into individual health problems and reduced ability to learn skills due to intrauterine trauma, further negatively impacting the long-term economy.

While the experiment designed by Cejka & Waseem (2022) suffers from a lack of rigour in the causal relationship between confounding variables and the derivation of conclusions, the perspective introduced by the experiment and the selection of the experimental data brings a new direction for thinking and understanding to the reader. The proxy test provides a better and more rigorous framework for a more scientific inquiry into the impact of in-utero exposure on long-term economic development by using sample refinement, further control of confounding variables and longitudinal data

studies as entry points.

At the same time, Cejka & Waseem (2022) hope that this study and analysis will make more pregnant women of the Islamic faith aware that non-compulsory fasting during pregnancy can reduce the incidence of poor learning and ill health in infants due to maternal fasting during pregnancy by postponing fasting to a non-pregnant period. The negative impact of the impact on the foetus in the womb on individual development and socio-economic well-being is worthy of in-depth consideration and reflection in many ways.

All countries worldwide (especially countries where Islam is prevalent) should have a government policy to guide their followers to fast scientifically and rationally. Muslim pregnant women must not only fast for a reasonable period without violating religious rules but also from a humanitarian and human health perspective. It is also important to raise awareness of the need to protect children in the womb and to provide protection for the growth and development of the babies themselves, thus reducing the potential impact on long-term economic development. It is important for researchers to look at the underlying causes of these misconceptions and to find the most intuitive and cost-effective ways of enhancing the future development of the children affected.

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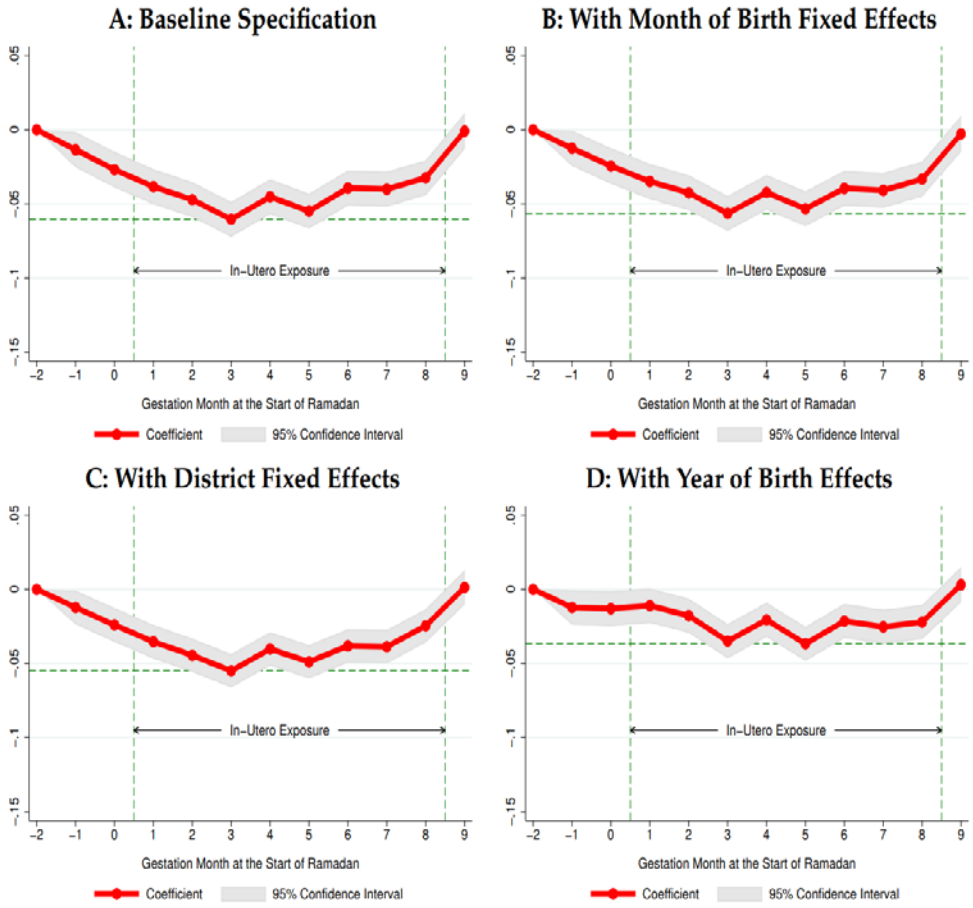
Appendix：

Figure 1: In-utero Ramadan Exposure and Earnings (Mazhar Waseem & Timotej Cejka,2022)



Notes: The figure explores the relationship between earnings and Ramadan exposure. We divide individuals into 12 groups depending upon the gestation month in which they experience Ramadan. Individuals in month 0 are conceived in the same month Ramadan began in. For example, in 1975 Ramadan began on the 8th of September. Individuals conceived between 8th September and 7th October are included in group 0. We find the conception date by subtracting the normal gestation length of 266 days from the exact date of birth. Individuals in months $[1, 8]$ are exposed, in month 0 and 9 are partially exposed, and other are not exposed. We estimate a version of equation (1) and plot the coefficients $\hat{\beta}_\mu$'s along with the 95% confidence interval around them. We progressively introduce our three main sets of control: month of birth fixed effects in Panel B; district of birth fixed effects in Panel C; and year of birth fixed effects in Panel D. The sample includes all tax returns filed in 2007–2009. The horizontal dashed line indicates the minimum $\hat{\beta}_\mu$ from the regression, showing the gestation month of exposure for which we estimate the strongest negative effect.

Table 1: In-utero Ramadan Exposure and Sex Ratios (Mazhar Waseem & Timotej Cejka,2022)

Gestation Month at the	Tax Data		DHS Data	
Start of Ramadan	(1)	(2)	(3)	(4)
-1	0.002	0.003	-0.004	-0.004
	(0.002)	(0.002)	(0.009)	(0.009)
0	-0.001	0.001	0.005	0.007
	(0.002)	(0.002)	(0.010)	(0.010)
1	0.000	0.003	0.013	0.013
	(0.002)	(0.002)	(0.009)	(0.009)
2	-0.004*	-0.001	0.006	0.007
	(0.002)	(0.002)	(0.010)	(0.010)
3	-0.002	0.001	0.003	0.001
	(0.002)	(0.002)	(0.009)	(0.009)
4	-0.003	0.000	0.002	0.002
	(0.002)	(0.002)	(0.009)	(0.009)
5	-0.003	-0.000	0.003	0.002
	(0.002)	(0.002)	(0.009)	(0.009)
6	-0.001	0.001	0.005	0.004
	(0.002)	(0.002)	(0.009)	(0.009)
7	-0.000	0.000	0.003	0.003
	(0.002)	(0.002)	(0.010)	(0.010)
8	-0.002	-0.002	0.003	0.003
	(0.002)	(0.002)	(0.009)	(0.009)
9	-0.001	-0.001	0.006	0.005
	(0.002)	(0.002)	(0.009)	(0.009)
Observations	437,145	437,122	116,656	116,656
Mean Value	0.109	0.109	0.483	0.483
Fixed Effects:				
Month of Birth	-	✓	-	✓
District of Birth	-	✓	-	✓
Year of Birth	-	✓	-	✓

Notes: The table estimates the effects of in-utero Ramadan exposure on the sex ratio. We estimate our equation (1) using an indicator that individual i is a female as the outcome variable. The first two columns estimate the equation using the tax return data and the last two using the DHS data. We use sampling weights for the last two specifications so that the results are nationally representative. Even-numbered columns include the month, district, and year of birth as controls. Standard errors are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Table 2: Heterogeneity in Ramadan Effect – Location (Mazhar Waseem & Timotej Cejka,2022)

In-Utero Ramadan	Outcome: Log Earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
1st Trimester	-0.270***	-0.267***	-0.065***	-0.064***	-0.234***	-0.022**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.008)	(0.010)
2nd Trimester	-0.256***	-0.255***	-0.051***	-0.051***	-0.234***	-0.023**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.010)
3rd Trimester	-0.223***	-0.221***	-0.020**	-0.020**	-0.221***	-0.012
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.010)
1st Trimester × Major City	0.440***	0.440***	0.038**	0.041***	0.429***	0.016
	(0.008)	(0.008)	(0.015)	(0.015)	(0.007)	(0.015)
2nd Trimester × Major City	0.418***	0.415***	0.015	0.015	0.419***	0.003
	(0.008)	(0.008)	(0.015)	(0.015)	(0.007)	(0.015)
3rd Trimester × Major City	0.396***	0.392***	-0.002	-0.003	0.413***	-0.000
	(0.008)	(0.008)	(0.015)	(0.015)	(0.007)	(0.015)
Observations	832,175	832,175	832,096	832,096	832,175	832,096
Joint test, coefficients on three Trimester × Major City equal 0:						
p-value	0.000	0.000	0.001	0.000	0.000	0.364
Fixed Effects:						
Month of Birth	-	✓	-	✓	-	✓
District of Birth	-	-	✓	✓	-	✓
Year of Birth	-	-	-	-	✓	✓

Notes: The table reports estimates from an augmented version of equation (2), where we add double interaction terms interacting the exposure month ($\mathbb{1}\left[em_i \in \{-1, 0\}\right]$) and trimester ($\mathbb{1}(et_i = \tau)$) dummies with the dummy variable Major City. The dummy variable takes the value 1 if the district of birth of individual i is one of the three major cities of Pakistan in terms of per-capita income—Karachi, Lahore, and Islamabad. The sample here includes tax returns filed in the tax years 2007–2009. The outcome variable is the log of taxable income of the individual. Standard errors are in parentheses and clustered at the individual level. ***, **, and * denote significance at the 1%, 5%, and 10% levels.