

Family Expenditure Patterns in the Asian Financial Crisis and Children's Cognitive Development in Indonesia

(*Corak Perbelanjaan Keluarga semasa Krisis Kewangan Asia dan Perkembangan Kognitif Kanak-Kanak di Indonesia*)

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ABSTRACT

The objective of this study is to examine the impact of the 1997 Asian Financial Crisis on children's cognitive development by analyzing how changes in family expenditure patterns affected cognitive outcomes. This study used data from IFLS2 to IFLS3 and applied Ordinary Least Squares, Propensity Score Matching, and Instrumental Variables techniques to analyze the impact of the financial crisis on children's cognitive development through changes in family expenditure patterns. The results from the three estimations indicate that the decline in household expenditure had a negative impact on children's cognitive development during the 1997 economic crisis. Children from families affected by the crisis exhibited lower cognitive performance, particularly among the low-income group. It indicates that there is a relationship between children's cognitive and economic crisis that is influenced by parents' inability to provide sufficient non-food expenditures. This study contributes to the literature by incorporating family expenditures into the explanation of the financial crisis's effect. The role of cash assistance as a safety net is crucial so that children, especially those from low-income families, can enhance their cognitive abilities during a crisis, as it can serve as one of the coping mechanisms to meet their educational needs.

Keywords: Children cognitive; Asian crisis; IFLS; instrumental variable; propensity score matching

ABSTRAK

Objektif kajian ini adalah untuk meneliti kesan Krisis Kewangan Asia terhadap perkembangan kognitif kanak-kanak dengan menganalisis bagaimana perubahan dalam corak perbelanjaan keluarga mempengaruhi hasil kognitif. Kajian ini menggunakan data daripada IFLS2 hingga IFLS3 dan mengaplikasikan teknik Ordinary Least Squares, Propensity Score Matching, serta Instrumental Variables untuk menganalisis kesan krisis kewangan terhadap perkembangan kognitif kanak-kanak melalui perubahan dalam corak perbelanjaan keluarga. Hasil daripada ketiga-tiga kaedah anggaran menunjukkan bahawa penurunan perbelanjaan isi rumah memberi kesan negatif terhadap perkembangan kognitif kanak-kanak semasa krisis ekonomi 1997. Kanak-kanak daripada keluarga yang terjejas oleh krisis menunjukkan prestasi kognitif yang lebih rendah, khususnya dalam kalangan kumpulan berpendapatan rendah. Dapatan ini menunjukkan bahawa terdapat hubungan antara perkembangan kognitif kanak-kanak dan krisis ekonomi yang dipengaruhi oleh ketidakupayaan ibu bapa untuk menyediakan perbelanjaan bukan makanan yang mencukupi. Kajian ini menyumbang kepada literatur dengan memasukkan perbelanjaan keluarga sebagai faktor dalam menjelaskan kesan krisis kewangan. Peranan bantuan tunai sebagai jaringan keselamatan adalah penting supaya kanak-kanak, khususnya daripada keluarga berpendapatan rendah, dapat meningkatkan keupayaan kognitif mereka semasa krisis, kerana ia boleh berfungsi sebagai salah satu mekanisme penyesuaian untuk memenuhi keperluan pendidikan mereka.

Kata kunci: kognitif kanak-kanak; krisis Asia; IFLS; pemboleh ubah instrumental; padanan skor kecenderungan

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INTRODUCTION

Previous literature suggests that higher cognitive achievement can lead to economic prosperity, thereby contributing to the national or regional wealth (Hanushek & Woessmann 2007). Hanushek et al. (2016) argue that the years of education level,

when combined with a measure of cognitive abilities, offer a more comprehensive understanding of individual differences in labour-market abilities.

Specifically, a child's cognitive ability plays a central role in the efficiency of returns and costs of human capital investment. A child's cognitive ability plays a key role in shaping returns to education, as parents often base their investment decisions on perceived differences in their children's cognitive potential (Dendir 2014). Additionally, it is important to note that this development is strongly influenced by external factors present in the environment where children are raised. Therefore, it is crucial to consider these external factors and invest in improving them to ensure a thriving future for individuals and society as a whole.

Similar adverse effects have been observed across various economic crises, such as the Mexican crisis of 1995, the global financial crisis of 2008, and the recent COVID-19 pandemic. These events have consistently shown detrimental impacts on household expenditures and children's well-being (McKenzie 2003; Funkhouser 1999; Behrman 1999). For instance, Lundberg and Wuermler (2012) highlighted that the 2008 crisis significantly reduced investments in children's education and nutrition in low-income countries. More recently, Egger et al. (2021) found that the COVID-19 pandemic led to income losses, resulting in substantial cuts to household spending on children's needs and potentially undermining cognitive development.

In mid-1997, Indonesia experienced a financial crisis that raised the poverty rate from 17% to 24% (Suryahadi et al. 2012). This caused around 14 million people in Indonesia to fall into poverty, bringing the total number of poor people, including children, to 48 million (SMERU Research Institute & UNICEF 2013). The country was hit hardest by the crisis compared to other Southeast Asian economies, with its economy shrinking by 13.6% in 1998—twice the rate of Malaysia and Thailand (Hill 2016). Indonesia is also recovering more slowly than other Southeast Asian nations (Azis 2008; Gill & Kharas 2007; Stiglitz & Yusuf 2001; Wie 2003).

Regarding the long-term effects of the crisis, Rizky et al. (2019) state that children born in low-income families are likely to remain poor as adults. In Indonesia, poverty experienced by toddlers under 7 years old and children between 7 and 14 years old affects their cognitive development, as noted by Maika et al. (2015 2017). Early intervention to boost household income has a greater impact than intervention later in childhood, although both are equally vital. Another study in India found that children's cognition is most responsive to investments made between the ages of 1 and 12, as highlighted by O. P. Attanasio et al. (2017).

Children are the group most deeply impacted by economic crisis, with their families and surroundings playing a major role in shaping their experiences during these times. Consequently, those living in poverty are more likely to experience harsh conditions than peers from more affluent backgrounds (McLoyd 1998). The socioeconomic status of a neighborhood significantly influences children's development, particularly among socioemotional adolescents (Leventhal 2018). Additionally, disadvantaged neighborhoods can harm children's cognitive skills before and during kindergarten (Vinopal & Morrissey 2020). In Canada, Webb et al. (2017) found a correlation between neighborhood vulnerability and poor developmental health among children from disadvantaged backgrounds.

During a crisis, people often cope by reducing household expenses. Atinc and Walton (1998) found that some individuals reduced their food intake to just two or even one meal per day. In Indonesia, school principals have reported that parents are struggling to pay parent association fees on time. As a result, children are arriving at school hungry and buying less from vendors. This situation has negatively impacted the children's well-being and academic performance, with the Asian financial crisis indirectly worsening their outcomes.

To assess the severity of an economic crisis, researchers such as Dong (2018) and Frankenberg et al. (1999) have measured the deviation of consumption growth during a crisis from pre-crisis trends. However, these studies often use consumption deviation at the district level to control for unobserved household variables. This approach is partly due to the limitations of the National Social-Economic Household Survey (SUSENAS), which provides data only at the sub-district level. SUSENAS has been collecting consumption data for decades and is regarded as one of the most accurately recorded sources of household outcomes in Indonesia.

Several studies have examined the factors that influence children's cognitive development from various perspectives. Attanasio et al. (2020) used a production function to explain how parental investments affect cognitive development. In Indonesia, Maika et al. (2017) and Cameron et al. (2021) employed a multidimensional approach to identify the determinants of children's cognition, recognizing that multiple factors can play a role. Zhang (2021) analyzed how socioeconomic status influences adolescents' cognition. Additionally, Bisharat et al. (2020) investigated children's cognitive ability during the economic crisis and political conflict in Palestine.

In 2018, a period free from crisis, Indonesia ranked among the lowest 10 out of 79 participating countries in the PISA assessment. The country placed 71st in science literacy and 70th in reading literacy, with scores of 396 and 371, respectively, both below the OECD average. Indonesian students' competencies in reading, mathematics and science competencies were also below the ASEAN average. These persistently low outcomes highlight ongoing systemic challenges in the quality and effectiveness of Indonesia's education system.

TABLE 1. Students' PISA scores in some ASEAN countries 2018

Countries	Reading	Mathematics	Sains
Phillipines	339	352	357
Thailand	392	418	425
Indonesia	371	379	396
Malaysia	415	440	438
ASEAN	413	431	433

Source: Indonesia Centre for Educational Assessment (2019)

To understand these outcomes, it is important to examine the underlying dynamics of educational investment. Children's cognitive development can be viewed as an uncertain return on such investments, making finance theory, especially risk aversion related to future income (Hartarto et al. 2023). During crises like the Asian Financial Crisis, household expenditures often decrease, which may lead to a reduction in parental investment in education. Through this mechanism, this study investigates how financial constraints in times of crisis can lead to declines in cognitive development, ultimately forcing households to prioritize immediate survival over their children's future earning potential and risk preferences.

A key challenge in studying the relationship between economic crisis and children's cognition is establishing causality. Previous studies have used various approaches to investigate causal links between neighborhood conditions and children's cognitive development. These include experimental or quasi-experimental residential studies such as Rubinowitz and Rosenbaum (2000) and the Moving to Opportunity experiment (Goering & Feins 2003), where families were randomly assigned housing vouchers. In Indonesia, Maika et al. (2015) used Inverse Probability Treatment Weighting to minimize the endogeneity between family income and children's cognitive ability. Cameron et al. (2021) used district-fixed effects to reduce confounding factors. Additionally, several studies have employed instrumental variables to overcome omitted variable bias in neighborhood conditions (O. Attanasio et al. 2020; Chevalier et al. 2013; Levy & Duncan 2000; Rizky et al. 2019).

Although earlier studies, such as Maika et al. (2015) and Rizky et al. (2019), have addressed socioeconomic conditions during times of crisis, these studies did not explicitly examine the economic crisis itself as a standalone factor affecting children's cognitive outcomes. Likewise, this study does not treat the economic crisis as a direct variable of interest, but rather considers the timing of the Asian financial crisis.

Bisharat et al. (2020) investigated the effects of the Palestinian political conflict using a quasi-experimental approach, and Rajmil et al. (2015) studied the impact of the economic crisis on Spanish children's health. It is well established that early childhood experiences have long-term effects on adult outcomes, such as income and productivity. Prior research has also found that children from low-income households are more vulnerable to economic crises, as shown by Case et al. (2005), Currie & Hyson (1999), Currie & Stabile (2003) and Rizky et al. (2019).

Children's cognitive development is crucial for their future success, yet the specific impact of economic crisis on cognitive abilities remains underexplored. This study aims to fill that gap by examining how the 1998 Asian financial crisis affected children's cognitive development in Indonesia. We employ the Ordinary Least Squares, Two Stage Least Squares (TSLS) and the Propensity Score Matching (PSM) methods to identify the factors influencing children's cognitive ability. Our findings reveal that the Asian financial crisis negatively impacted the cognitive development of Indonesian children. These results underscore the importance of mitigating the effects of economic crisis on children's cognitive outcomes and investing in their development for a brighter future.

METHODOLOGY

DATA

This study utilized household-level survey data from the Indonesian Family Life Survey (IFLS) at the household level, specifically from the second wave (1997) to the third wave (2000). The IFLS is a longitudinal dataset on households, collected by the Rand Corporation in collaboration with various survey institutions. The survey began in 1993 and was conducted again in 1997, 2000, 2007, and 2014. It provides demographic, socioeconomic, and behavioral information for individuals and households at the village level. The first wave of data (IFLS1) was collected in 1993 from 22,000 people in 7,200 families across 13 provinces in Indonesia. Claiming national representativeness and covering 83% of the population. The IFLS is designed as a longitudinal data set, with each subsequent wave following respondents from the 1993 cohort, along with newly added generations. As a result, the number of respondents increases with each wave (RAND, 2000, 2009).

The research focused on households comprising both parents and children, utilizing data from the second and third waves of IFLS. The study tracked the same group of children (respondents under 15 years old) from IFLS2 in 1997 to IFLS3 in 2000. By analyzing both individual and environmental factors, it explored changes in children's cognitive abilities over the four years surrounding the Asian financial crisis (culminating in IFLS3 in 2000). During the study period, the research sample size was reduced due to attrition, mainly attributed to untraceable respondents resulting from death or migration. Ultimately, the study

included 4,204 children with complete information available for both 1997 and 2000. Of these, 342 children experienced a decrease in income due to the economic crisis, while 3,863 children did not.

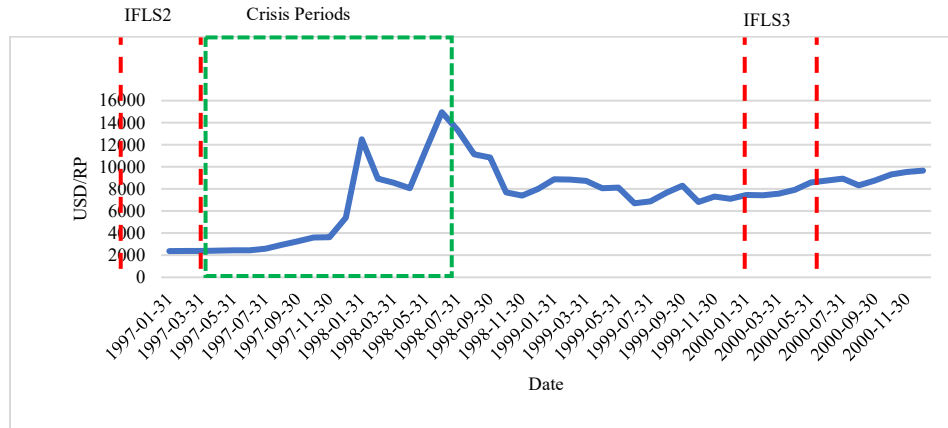


FIGURE 1. Exchange rate movement, timing of crisis and timing of IFLS 2 and IFLS were fielded

Table 2 summarizes the statistics of the 4,204 individuals in the study sample compared to the broader Indonesian population. The results indicate that the average cognitive score among participating children was 0.62. Most of the sampled children lived in rural areas, and there was no significant difference in scores between rural and urban samples.

Additionally, this study aims to determine whether a household has experienced a crisis by analysing the variance between household expenditures in 2000 and 1997. We expect that household spending on children's needs would increase, but we found that 8% of our sample had decreasing expenditures. This distinction can help identify households that went through the Asian financial crisis.

TABLE 2. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Children Cognitive Score	4,204	0.6237057	0.2401776	0	1
Delta Expenditure	4,176	76.66531	59.99331	-256.7551	367.8781
Cash Assistance	4,058	0.0569246	0.231727	0	1
Child's Gender	4,204	0.5128449	0.4998944	0	1
Household Size	4,204	5.681256	1.854247	1	15
Parent's Working Status	4,204	0.7114653	0.4531349	0	1
Residence: Urban/rural area	4,204	0.4072312	0.491377	0	1
Father's education	4,204	5.959087	4.360208	0	18
Mother's education	4,204	5.064225	4.043678	0	18
Dummy of delta expenditures	4,204	0.0811132	0.2730414	0	1
Natural logarithm of total price of goods	4,105	8.811493	0.9667313	5.298317	12.65044
Per capita expenditure	4,193	191619.7	205913.5	11700	3079063

Source: Authors' calculations based on IFLS data (1997 and 2000)

In 2000, Indonesia continued to face the effects of an economic crisis, particularly in urban sectors such as construction, manufacturing, and service, which saw significant job losses. As a result, household incomes declined, and approximately 8% of households reported a reduction in their expenditures. Table 3 presents the percentage changes in monthly household expenditures across various income groups for the year 2000, highlighting the ongoing impact of the 1998 economic crisis. Some households experienced an average income loss of IDR 1,387,700.

The data indicate that low-income households, those with monthly spending below IDR 105,686, experienced the most severe cutbacks. For instance, their spending on education tuition dropped by 86.5%, compared to only a 5.5% decline among high-income households. Medical expenses also dropped sharply, with reductions of 559% and 602% for middle- and low-income groups, respectively, suggesting that many families either delayed or altogether avoided necessary healthcare. Similarly, education transportation expenditures fell sharply for poorer groups, likely reflecting reduced school attendance or logistical obstacles.

In contrast, high-income households demonstrated greater resilience, increasing their spending on food, uniforms, and utilities. Notably, per capita expenditure rose by 49.7% for high-income households but declined by 58.2% for low-income households, highlighting widening inequality. These disparities had direct consequences for children: reduced spending on education among low-income families often resulted in delayed school enrollment or increased dropout rates. As Abbas (2019) noted, the economic crisis forced many children out of school due to financial hardship and an unsuitable learning environment.

Islam & Siwar (2005) found that spending patterns for food and non-food items change significantly during a crisis year. Specifically, the elasticity of food expenditure during a crisis indicates that food becomes even more essential. In contrast, the elasticity of non-food expenditure increases, suggesting that non-food items are treated as luxuries and their consumption is reduced more sharply in times of economic hardship. Overall, Table 3 underscores how economic shocks disproportionately affect the most vulnerable, especially in areas critical to children’s long-term development.

TABLE 3. Percentage changes in amount of different monthly household expenditures (by Income Group)

Expenditures (i)	High-Income Level Group (ii)	Middle-Income Level Group (iii)	Low-Income Level Group (iv)
Education Tuition	-5.5%	-9.8%	-86.5%
Education Transportation	6.44%	-38.7%	-54.2%
Uniform	26.6%	20.4%	10%
Food	49%	33%	5.4%
Medical	-122%	-559%	-602%
Electricity and Water	36%	-2.4%	-21.8%
Clothes	11.9%	8%	-9.5%
Per Capita Expenditure	49.7%	28.7%	-58.2%

Percentage change in expenditure in 2000

Source: Authors’ calculations based on IFLS data (2000)

Recent studies have further confirmed these spending patterns in the context of the global financial crisis and the COVID-19 pandemic. As households tightened their budgets, low-income families increasingly prioritized food expenditures, while spending on non-food items declined significantly (Friedman & Schady 2009; Egger et al. 2021). For example, Antelo et al. (2017) found that the impact of unemployment on food spending was especially pronounced among disadvantaged households in Spain, underscoring food’s status as a necessity during crises. Likewise, Ellison et al. (2020) observed that U.S. households shifted their spending from food consumed away from home to food at home, often trading off nutrition and price in favor of accessibility and convenience.

Table 4. Children’s cognitive score (by Experience of Asian Financial Crisis)

Children’s Cognitive Aspects (i)	All samples (ii)	Sub-sample: household with experience in Asian Financial Crisis (iii)	Sub-sample: household without experience in Asian Financial Crisis (iv)
Abstracts	7.77	7.56	7.91
Math	2.82	2.88	2.81
Total correct answers of 17 questions	10.59	10.45	10.60
Fraction of right answers	0.62	0.61	0.62

Source: Authors’ calculations based on IFLS data (2000)

Table 4 presents the average cognitive scores of children, differentiated by whether their households were affected by the Asian Financial Crisis and those that were not. The cognitive measures include abstract reasoning, math skills, the total number of correct answers out of 17 questions, and the fraction of correct answers. Table 4 shows results for the full sample (column ii), as well as two subsamples: children from crisis-affected households (column iii) and those from unaffected households (column iv).

Although the differences in cognitive scores between the two subgroups (columns iii and iv) are not significantly different, the direction of these differences and their potential underlying mechanisms remain important to consider. Children from crisis-affected households have slightly lower average scores across all domains compared to those from unaffected households. While these differences are small, they suggest a possible pattern: the exposure to an economic crisis may lead to subtle disadvantages in cognitive development.

It is also possible that children in both groups eventually caught up due to post-crisis recovery, thereby masking any short-term effects. Nonetheless, the consistency of lower scores across multiple cognitive measures among children from crisis-affected households implies a possible latent impact of economic shocks on children’s learning. Moreover, the cognitive consequences of such a crisis often materialize gradually. Immediate effects, like reduced household spending on education, nutrition, and health, may not be reflected in cognitive tests until later developmental stages.

EMPIRICAL STRATEGY

The baseline multivariate framework used to test the impact of the Asian financial crisis on children’s cognitive development is given by:

$$Y_{jk} = \beta_1 + \beta_2 X_{jk} + \beta_3 H_{jk} + \beta_4 C_{jk} + \beta_5 I_{jk} + \varepsilon_{jk} \quad (1)$$

Y_{jk} represents the children's cognitive ability for child j and household k . The main explanatory variable of interest H_{jk} is a vector representing parental investments at the household level. This vector includes specific variables such as household expenditure on clothes, food, health, and education. Additionally, the vector accounting for household or neighborhood conditions includes factors such as residential status, parents' employment status, the education levels of father and mother, and household size. C_{jk} is a dummy variable indicating whether household k received government cash assistance. The covariates I_{jk} capture individual characteristics such as the gender and age of child j in household k .

This study employs three different econometric approaches to estimate Equation (1). The first is a baseline estimation using Ordinary Least Squares. Given the potential bias in the treated group (households with reduced expenditure), the study also utilizes propensity score matching (PSM) to estimate the average treatment effect of changes in parental investment (such as spending on children's clothes and education) between 1997 and 2000.

When applying PSM, it is necessary to make assumptions regarding the selection of observable attributes. The variability in selection affects how the treatment and control groups are formed. In this study, the treatment group consist of households with decreased expenditures between 1997 and 2000. PSM is used as a complementary estimation to address potential selection bias when estimating the causal effect of reduced household spending on children's cognitive development. Selection bias may occur because households experiencing a decline in spending during the crisis may differ from those that do not. PSM mitigates this potential bias by matching and constructing treatment and control groups with similar observed characteristics.

The propensity score is defined as:

$$P(X) = Pr(D = 1 | X) \quad (2)$$

D is a binary indicator equal to 1 if a household experienced a decrease in expenditure between 1997 and 2000, and X is a vector of pre-treatment covariates. By matching and constructing treated and control households with similar propensity scores. PSM enables us to estimate the Average Treatment Effect on the Treated (ATT), the impact on the outcome between treated and control households after matching. To ensure the consistency of the estimated ATT in this study, we use four matching algorithms: Nearest Neighbor (NN), Calliper and Radius, Stratification and Interval, and Kernel and Local Linear Weighting.

In addition to the initial two estimates, a third estimate is carried out using instrumental variables analysis to address endogeneity. Children's cognition and parental investment are probably interconnected for several reasons, mainly due to simultaneity and omitted variable bias. A simple OLS regression of parental investment on children's cognition is unlikely to yield a causal estimate. Parents often adjust their investment based on their child's visible abilities or progress. If a child needs early cognitive stimulation, parents may be more inclined to invest in extra learning opportunities. This creates a feedback loop where parental investment affects cognition, and cognition, in turn, influences the type of investment made. Additionally, potential endogeneity may arise from omitted variable bias, involving unobserved factors that influence both parental investment and children's cognitive outcomes, such as parental motivation, socio-emotional environment, parental IQ, and stress levels. If these factors are not taken into account, the estimated impact of parental investment on cognition could be biased.

The TSLS estimations are conducted in two stages:

First stage:

$$H_{jk} = \pi_0 + \pi_1 Z_{jk} + \pi_2 X_{jk} + \mu_{jk} \quad (3)$$

Where H_{jk} (household expenditure change) is the endogenous variable, Z_{jk} represents instruments (total price of food), and X_{jk} represents control variables.

Second stage:

$$Y_{jk} = \beta_0 + \beta_1 \hat{H}_{jk} + \beta_2 X_{jk} + \varepsilon_{jk} \quad (4)$$

Where Y_{jk} represents children's cognitive score, and \hat{H}_{jk} represents the predicted value from the first stage.

In this study, we used the decrease in household expenditures on education, food, medical, and clothing between 1997 and 2000 as an instrumental variable. The total price of food serves as an indicator of the general good prices of goods at the community level. According to O. Attanasio et al. (2020) and O.P. Attanasio et al. (2017), the prices of children's goods and

household resources are influenced by local budget constraints and are consistent with the local prices level. Price variability is determined by supply-side changes and is not related to shocks or unobserved factors in the model. By accounting for total food prices at the community level, this study argues that the children’s cognitive development requires long-term support, as it depends on both nutritional and non-nutritional interventions.

Parental education is widely recognized as a key factor in their children's educational outcomes. However, its impact is not always direct. Parental socioeconomic status, particularly education, may influence parenting practices and approaches, which in turn affect their children's cognitive development (Lundborg et al. 2018; Sacerdote 2000; Xu et al. 2022). This influence is mediated through a "nurturing" effect, where parental education shapes the environment for cognitive growth. Sacerdote (2000), for example, demonstrated significant positive impacts of parental education on cognitive test results of a small sample of Korean adoptees in the USA. Parents who understand the benefits of investing in food, clothing, healthcare, and education for their children tend to allocate more resources to these areas (O. Attanasio et al. 2020).

COGNITIVE SCORE CONSTRUCTION

The IFLS assesses children’s cognitive abilities using logical questions and basic calculations. Cognitive scores are derived from a subset of Raven’s Progressive Matrices (RPM), which measures general intelligence by both genetic and environmental factors. The test evaluates two main components of cognitive ability: deductive ability, the capacity to make sense of complexity, and interpret high-level nonverbal information. Second, reproductive ability, which reflects the ability to absorb, remember, and reproduce explicit information communicated by others.

Because children's cognition is related to age, scores are standardized using a z-score. Cameron et al. (2021) analyzed children's cognitive tests in IFLS, calculating them as the fraction of correct answers out of 17 questions. These cognitive questions were adapted from test abstracts and mathematical items based on RPM measurement. Scores range from 0 to 1, with higher scores indicating stronger cognitive ability.

RESULTS AND DISCUSSIONS

THE EFFECTS OF THE ASIAN FINANCIAL CRISIS (DECREASING HOUSEHOLD EXPENDITURES) ON CHILDREN’S COGNITIVE DEVELOPMENT

During the Asian financial crisis, household expenditures on children's needs decreased, affecting all households in Indonesia. Parents believe that children's well-being is influenced by nutrition, the fulfilment of basic needs, and genetic endowment. This means that having enough money is crucial for children's needs. Cognitive ability is closely linked to the structure of the brain, which is influenced by genetics, environment (including nutrition, the absence of toxins, and healthy personal and social behaviours of expecting mothers), and experience (how a child interacts with their environment). In situations like the 1998 economic crisis, 14 million Indonesians were classified as poor, bringing the total poor population to 48 million, including children. The crisis caused households to suffer from reduced income and limited ability to meet basic needs.

An initial analysis was conducted using Ordinary Least Squares (OLS) estimation. The findings indicate that changes in household expenditure do not significantly affect children's cognitive abilities. However, the educational levels of both the father and mother have a positive influence on children's cognitive scores, with increases of approximately 0.5% and 0.8% respectively. Additionally, living in an urban area may lead to improved cognitive abilities due to the availability of facilities, in comparison to children living in rural areas in Indonesia.

Given the potential incomparable groups between the treated and control groups, the study conducted a second estimation using Propensity Score Matching to analyze the impact of the crisis on households. Table 5 indicates that the cognitive test scores for the treatment group (households with decreasing expenditure on children's needs) decreased by 0.005% on average in NN matching with replacement and by 0.023% on average in NN without replacement. It indicates that households experiencing declines showed lower average cognitive test scores than unaffected households, although the differences were not statistically significant. To ensure the reliability and consistency of the results, the study conducted additional estimation tests using different matching estimators, including Calliper matching and Kernel matching. The results indicate consistency across different matching estimators.

TABLE 5. Propensity score matching estimation

Matching Method	Effect	SE	t-stat
NN with replacement	- 0.005	0.019	-0.26
NN without replacement	-0.023	0.016	-1.40
Kernel	-0.014	0.012	-1.15
Radius Calliper	-0.016	0.012	-1.29

Source: Authors’ calculation (2022)

Table 6 shows the effects of the Asian financial crisis and how other factors affect the children's cognitive scores. The results from the Two-Stage Least Squares (TSLS) analysis support the parental investments theory presented by Hoffman and Mayer (1997), which suggests that parents play a crucial role in investing time and money in their children through education, health, and a proper home environment.

The results show that when parents reduced their spending on education, food, and non-food items such as clothing, medical care, and household supplies, it had a negative impact on their children's cognitive scores. Specifically, the research showed that the decrease in household expenditures significantly lowered children's cognitive scores by 1.58% in the TSLS estimation. This suggests that when households experience reduced expenditures (such as an income shock) due to a crisis, parents may struggle to fulfil their children's needs, which can negatively affect their children's cognitive development.

The cost of living has risen due to various factors, including depreciation of the exchange rate, higher costs of traded goods, and price hikes in the public sector. A study by Atinc & Walton (1998) showed that in Indonesia, where the exchange rate has declined by 80% since July 1997, the cost of antibiotics doubled between October 1997 and March 1998. During the same period, the Consumer Price Index (CPI) for food increased by over 50%, compared to a 38% increase in the general CPI. This has led to a significant increase in the cost of drugs across the region, particularly in Indonesia. To cope with the situation, households are advised to adjust their expenses by shifting their children's expenditure to other costs, such as tuition, or cutting down on household expenses, including children's meals.

During crisis periods, low-income households tend to prioritize food expenditure over non-food expenditure. The elasticity of expenditure on food products was found to be lower than in previous crisis years, indicating that food has become a greater necessity. In this study, food expenditure includes vegetables, rice, and other nutritious foods best suited for children, including both luxury and staple foods. On the other hand, non-food expenditures such as education, health, clothing, and housing became more luxurious during crisis periods (Islam & Siwar 2005).

TABLE 6. The effects of the Asian financial crisis (Delta Expenditures) on children's cognitive development

Dependent variable: Children's Cognitive Score	(1)			(2)			(3)		
	OLS			PSM			TSLS		
Delta Expenditures				0.0000135 (0.0000597)					-0.0158* (0.00815)
Treated group								-0.0219 (0.0137)	
Child's gender				0.0116 (0.00720)					0.00408 (0.0312)
Household Size				-0.000333 (0.00199)					-0.0452* (0.0254)
Household Head Working Status				0.0224** (0.00813)					-0.00318 (0.0359)
Urban/Rural				0.0639*** (0.00778)					-0.0671 (0.0747)
Father's Education				0.00466*** (0.00113)					-0.000187 (0.00545)
Mother's Education				0.00797*** (0.00124)					0.0137** (0.00583)
Cash Assistance				0.0753*** (0.0148)					0.0721 (0.0631)
Constant				0.516*** (0.0160)				0.629*** (0.00392)	2.041** (0.798)
N				4031				4058	3938

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

IV weakness test is obtained with an F-stat is 17.299, which is higher than the critical values at the 10% level using TSLS. The Hausman test for endogeneity of variable Delta Expenditures is significant at 5% with a P-value for the Wu-Hausman F test and Durbin-Wu-Hausman chi-sq test is 0.0001.

As we know, children's cognitive development is influenced by various factors, including nutrition and environment. Studies in the English education system have shown that household income significantly affects children's cognitive development. An increase of £1,000 in annual spending per child has been associated with test scores that were 2% to 7% higher (Holmlund et al. 2010; Nicoletti & Rabe 2012; Steele et al. 2007).

Parents' expenses are aimed at meeting children's basic developmental needs. Gregg et al. (2006) found that as income increased among low-earning families with children, the relative amount spent on children's clothing, footwear, toys, and books increased significantly. Additionally, there was an increase in expenditures on fruits and vegetables, and a decrease in spending

on alcohol and tobacco. Given tighter budget constraints, any changes or reductions in children's needs can hamper the progress of their cognitive development.

The results show that a mother's education has a significant impact on children's cognitive ability, as estimated by both OLS and TSLS. Dadhich & Faridi (2013) explain that 70% of nutrition interventions involve multiple sectors, including mothers' education. Pangaribowo et al. (2019) suggest that households may lack the knowledge to make the right choices to improve their overall welfare. They recommend that education and nutrition information for women could help to improve household welfare. This is consistent with Boneva & Rauh's (2018) findings, which show that investment perceptions differ by respondents' social background, and this has an impact on children's cognitive outcomes.

Children who live in urban areas tend to have higher cognitive levels than those in rural areas, where access to education is limited and parental awareness is lower. The socioeconomic status of a neighborhood can also have an impact on children's development, particularly socioemotional development (Leventhal 2018). The OLS estimation indicates that the Asian financial crisis had a greater impact on cognitive scores in rural areas. Webb et al. (2017) found that there is an association between neighborhood vulnerability and poor children's developmental health in Canada. However, this finding is inconsistent with TSLS estimation, and it is insignificant.

Friedman and Sturdy (2011) explain that children's cognitive development might be influenced by economic crisis in the long term. Although Indonesia's 1998 financial crisis ended years earlier, its impact, such as increased poverty, job loss, and reduced public spending, could have had delayed effects on children's cognitive development, especially those born during or just after the crisis through several pathways: (1) declines in households' purchasing power, (2) less time parents were available at home, (3) worsening conditions in the health environment (Hidrobo 2011), and (4) baby born in economic crisis have undernourished status affect their cognitive development in the future (Giles and Satriawan 2015).

TABLE 7. Mean score children's cognitive development across three IFLS waves (2000, 2007, and 2014)

Year	Total cognitive	Abstract	Math
2000	10.60	7.76	2.84
2007	11.25	8.50	2.74
2014	10.37	7.79	2.58

Table 7 presents the mean scores for children's cognitive test results in Indonesia across three survey years: 2000, 2007, and 2014, broken down into three categories: total cognitive, abstract reasoning, and mathematics. The data show that cognitive performance peaked in 2007. In that year, the average abstract reasoning was 8.50, and math was 2.74, both of which were higher than in the preceding and following years. In contrast, 2014 recorded the lowest scores among the three years: total cognitive ability dropped to 10.37, abstract reasoning to 7.79, and math to 2.58. Compared to 2000, while abstract scores slightly improved (from 7.76 to 7.79), both total cognitive and math scores declined. This finding suggests there a long-term impacts of economic crisis on children's cognitive development that should be considered by future research, given the delayed effects through some pathways.

The cash assistance policy in Indonesia has become a crucial social protection measure for the country's citizens. Since 2000, various organizations such as the National Foster Parents Movement (GNOTA), Parents and Teachers Association (POMG), religious and community groups, and the government have provided cash and social assistance to those in need. This study finds that the policy has no impact on children's cognitive ability, although its benefits include keeping students in school, improving cognitive abilities. In addition, the assistance helps households adjust their expenditures, particularly with medical expenses.

ROBUSTNESS CHECK: MAGNITUDE OF DIFFERENT INCOME LEVEL

The Asian financial crisis had a significant impact on the cognitive abilities of children from both low-income and high-income households. Low-income households experienced a 1.1% decrease in cognitive scores, while high-income households experienced a 0.682% drop. The result implies that during income shocks, poorer households are more affected and require more incentives to survive. Interestingly, only mothers' years of schooling had a significant impact on children's cognitive development, particularly in low-income groups. Educated mothers spent more time on childcare and enriching activities while staying at home, leading to better cognitive development in their children. This is supported by the hypothesis of financial limit human capital investments (Becker et al. 1986).

The coping mechanism of low-income groups during a crisis is to cut their budget, especially spending in education, which they deem less immediate compared to their basic needs. The crisis exacerbates the vulnerability of these households, as they are already under financial pressure even during stable economic conditions. Furthermore, this study highlights the importance of implementing targeted financial interventions, such as cash assistance programs, to buffer these effects by building sustainable resources and supporting cognitive development and educational spending in low-income households (Egger et al. 2021; Friedman & Sturdy 2011).

TABLE 8. The effects of the asian financial crisis (Delta Expenditures) on children's cognitive development by household income group

Dependent variable: Cognitive Score	(1)	(2)	(3)
	Low-Income Group	Middle-Income Group	High-Income Group
Delta Expenditures	-0.0110* (0.00584)	-0.0105* (0.00604)	-0.00682* (0.00372)
Cash Assistance	0.134** (0.0623)	0.0846 (0.0794)	-0.0337 (0.0892)
Gender of Children	0.0196 (0.0320)	0.00266 (0.0330)	-0.0314 (0.0345)
Household Size	-0.0140 (0.0123)	-0.0140 (0.0134)	-0.0155 (0.0149)
Household Head Working Status	0.00859 (0.0382)	-0.0436 (0.0444)	0.00563 (0.0366)
Urban/Rural	-0.0585 (0.0670)	-0.0624 (0.0789)	-0.114 (0.102)
Father's Education	-0.00276 (0.00676)	-0.0128 (0.0103)	-0.0123 (0.00889)
Mother's Education	0.00984* (0.00595)	0.00379 (0.00568)	0.00513 (0.00535)
Constant	1.337*** (0.470)	1.692** (0.666)	1.605*** (0.559)
N	1872	1248	817

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

CONCLUSION AND POLICY IMPLICATIONS

Cognitive ability is strongly linked to the structure of the brain, which can be influenced by genetics, environment (such as nutrition, the absence of contaminants, and a pregnant mother's healthy personal and social habits), and experience (including a child's interactions with their environment). In the mid-1990s, Indonesia faced a crisis that led to many workers being laid off, particularly in the modern urban-based construction, manufacturing, and service sectors, and to a drop in household income. Around 8% of households reported a decrease in income. This study proposed that the Asian financial crisis would lead to a decline in children's cognitive scores due to cuts in family expenditures. According to the theory of economic consumer behaviour, individuals strive to select a combination of goods to maximise their utility while staying within budget constraints. During the crisis, households attempted to shift their non-food expenses to food expenditures to achieve maximum utility. However, this shift affected children's cognitive development.

The research conducted using pooled cross-sectional data has revealed that the Asian financial crisis harmed the children's cognitive scores, especially those belonging to the low-income group. The cognitive scores of these children were found to be poorer due to their limited access to resources that can enhance cognitive development following the financial crisis. This indicates that the correlation between a child's cognitive development and an economic crisis is largely influenced by parents' inability to provide sufficient non-food expenses, such as educational and health needs.

To address this issue, policymakers in Indonesia must implement measures to support children through cash assistance during crises. This would not only enable children to stay in school but also improve their cognitive abilities, especially for households with low incomes, and mitigate the impact of the crisis. Parents must be made aware of the significance of investing in their children's education and health, which are major factors in developing their cognitive abilities. Additionally, future studies should employ more accurate proxies to explain the impact of economic crises on children's outcomes using the health production function. By considering detailed factors such as health inputs, nutritional status, and health practices, future studies can better evaluate the impacts of economic crises on children's cognitive outcomes (Grossman 1972; Friedman & Sturdy 2011). Moreover, extended time observation is needed to capture the long-term impact of a crisis on children's cognitive development.

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