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Mothers, Maids and Tutors: An Empirical Evaluation of their Effect on Children's Academic Grades in Singapore

ROLAND CHEO* and EUSTON QUAH**

**Monash University, Australia, **Nanyang Technological University, Singapore*

ABSTRACT *As female labour force participation in the workforce increases in Singapore, the basic economic unit—the home—has become wealthier, although arguably at the expense of both personal and family leisure. Yet with additional income, breadwinners are better able to undertake investment for their own well-being or their children's well-being that can offset the net loss of utility associated with less leisure. Concomitantly, it is common to find a domestic helper living with a Singapore family and other specialist helpers such as paid home tutors, who come to the home. This paper examines how this new investment vis-à-vis new home variables affects a child's overall academic performance. Primarily, the effects of a mother's choice to work, the presence of either tutors or domestic helpers and the effects of different investment strategies to raise a child's qualitative attributes. The paper asserts that how a child performs academically is less dependent on his/her choice of time use; rather, it is the number of qualitative benefits the child receives in the home environment. The conventional wisdom of 'the more the better' is questioned by the results of this study, arguing instead that diminishing returns set in far quicker when over-investment in the child takes place.*

KEY WORDS: Academic performance; domestic helper; Singapore; tutors; simultaneous equation probit model

Introduction

With the rapid pace of change in Singapore, the basic economic unit—the home—has undergone many changes. Socio-economic policies in Singapore have led to more women entering the labour market, similar to their counterparts in the West. Two main reasons—namely, increasing wage rates[1] and higher educational levels of women—account for this (see Ministry of Labour, 1994, 1996, 1997; *Straits Times*, 1997). From 1994 to 1997, the median gross monthly income of female professionals rose from about $2750 to $3500, an increase of 27% in nominal terms (21% increase in real terms).[2] The opportunity cost of staying at home has thus increased. Fiscal policy has also been designed to draw women back into the workforce, causing

Correspondence Address: Roland Cheo, Department of Economics, Monash University – Clayton, VIC 3168, Australia. Email: Roland.cheo@buseco.monash.edu.au

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many to stay even after childbirth. The majority of these fiscal policies use tax concessions and allowances aimed at working mothers, especially better educated women,[3] who remain in the workforce. In Singapore as in elsewhere, the market is restrictive in that flexi-hours and part-time work are limited, thus most women find it hard to optimally juggle between home and workplace. In line with governmental efforts to increase female labour force participation, traditional homemakers are choosing alternative childcare arrangements in order to work. Some choose to use formal care; others choose informal care arrangements. For more detailed literature on the subject of childcare, see Leibowitz *et al.* (1992) and Blau (1995). Many Singaporean parents choose to hire foreign domestic maids to do more menial tasks at home as well as take care of children, in order to continue working (see Chant and Mcllwaine, 1995; Wing Suen, 1993). This paper investigates the impact that these new home variables have on overall academic performance. We can, in one way, view the child's loss of academic quality as a result of reduced contact with the mother.[4] With the mother at work, the child faces a disutility to her being away. This can manifest itself in a child's rebellious attitude, a general lack in enthusiasm towards schoolwork, and/or the child's perception that the mother would not have the time to check on him/her.

Choosing to hire a maid does, however, differ from the other childcare arrangements even if a mother chooses to work. As the maid is responsible for taking care of the household chores, a mother will possibly have more contact time with her child after working hours, unless her preference for her child's quality is lower compared with her preference for leisure.

If a mother chooses to work, the added income from work allows her, in turn, to choose between added leisure activities like holidays and investments in her children. For more discussion on the subject, see Maassen (1994) The added investment can raise the quality of a child, as in investment in specialized activities (e.g., piano lessons, better schools, encyclopaedia sets and computer accessories). However, the effects are ambiguous. The model presented in this paper shows that a child's academic quality is related to wealth but is negatively related to expenditure solely for the benefit of the mother.

In Singapore, the hiring of a tuition teacher or private tutors is a type of investment not normally found in other countries, at least not in the large scale. Most students in Singapore have engaged a private tutor at some point in their schooling days. This is a specialized teacher focusing on the teaching of one or a few subjects. Given this additional specialized coaching, students are expected to perform better than their counterparts without tutors. However, the empirical results presented here question this assumption and assert that Singapore's tuition market may not be competitive. Alongside such considerations comes the added emphasis on artistic ability, a move towards more music, dance and drama lessons. These could set themselves up as goods that compete with grades, as they take time away from studies. Other competing goods are extra-curricular activities, the television and even the computer. In summary, the home determinants of a child's academic performance may include the following variables: the presence of a domestic maid; the presence of a private tutor; whether a mother works or not; whether a mother/sibling nurtures the child; as well as competing uses of time. For a theoretical treatment of these topics, see Becker (1991). Other empirical studies dealing with these issues can be found in Griliches and Mason (1972), Stafford (1974), and Leibowitz (1974a,b).

Yet Singaporean students are internationally recognized as being high achievers. The recent 1997 TIMSS study on Mathematics and Science placed Singaporean students ahead of 144 countries (see Canada Newswire, 1996; *Straits Times*, 1996). Singaporean students are therefore recognized as highly competitive and knowledgeable when compared against their international counterparts.

The paper investigates each of these effects and their impact (if any) on the academic performance of a child attending a school in Singapore. In order to isolate the direct impacts of home variables on academic performance, the sample chosen in this study is highly homogeneous and restricted to Singaporean students in upper-tier schools. In this way, school effects are similar across individuals. Most Singaporeans also recognize that several other factors contribute to aspects of quality building; that is, factors that enhance social, cultural and ethical standing. The choice to invest therefore becomes a decision to invest in areas accruing the greatest perceived benefit. The paper is organized as follows. In the next section a child's quality function is elucidated, The third section presents a model of a mother's choice in maximizing utility with consumption, leisure and investment of her child's quality as relevant endogenous variables. The model shows that any additional increase in academic quality above natural ability is dependent on the mother's preferences based on which is more beneficial to her; her own consumption or her child's academic performance. The second result shows that any additional increase in academic quality above natural ability is positively related to the mother's preference for her child's academic quality, as well as the amount of leisure time that she enjoys, but is inversely related to her preference for leisure.

A Child's Quality Function

The overall quality of a child is assumed to be a function of the following:

$$Q = Q(a, s, e, r, w)$$

where
a is academic ability (school grades), s is social skills (speech, deportment of a child), e is ethical behaviour (ability to distinguish right versus wrong), r is artistic ability (ability to create and innovate), and w is wealth (material goods and money that give opportunities for a child to self-actualize).

The choice to invest in one particular area may conflict with another. An example is taking too many ballet classes. Although this activity raises artistic ability, it takes time away from studies. Uninformed families can thus apportion investment into other areas that may increase the total quality of a child but lower his/her academic quality.

This is a result of a signalling problem. In recent years, Singapore has promoted the pursuit of increased productivity. Its vision of excellence covers all areas of life, which includes academic performance, artistic ability, social skills and ethical standing. An example would be the yearly selection of the President's Scholar; he/she would be a gifted student, an athlete and an active participant in social programmes. Parents thus have similar expectations of their child in light of these role models, viewing the pursuit of quality as the accumulation of all beneficial activities and introducing them early in the life of a child.

Ultimately, this issue of 'quality building' is a problem mainly caused by time allocation. If time were not a limiting resource, a child's grades would not suffer greatly even if he/she should take music, dance or academic lessons, as long as an efficient ratio between activities is met, *ceteris paribus*. However, as there is only a limited time endowment, time taken away from study would lower grades. Alternative activities compete for time in a child's 24-hour day. More time spent on non-academic artistic pursuits will lower grades in a child. This trade-off ultimately will disappoint parents expecting good academic results and, at the same time, high artistic talent from their children.

The Model

The mother's concern is to maximize her utility, assumed given by an additive log function:[5]
Max

$$\beta_1 \log(x - x_o) + \beta_2 \log(t_{wo} - t_w - t_{hh}) + \beta_3 \log(Q - Q_o) \qquad \text{where } \Sigma\beta_i = 1 \qquad i = 1,2,3$$

where β_1 is the mother's preference for consumption, β_2 is the mother's preference for leisure, β_3 is the mother's preference for child quality, x is the consumption of both mother and child jointly, x_o is the base level of consumption, t_{wo} is the maximum hours of market time available, or time spent awake, t_w is the time spent by the mother at the market activity, t_{hh} is the time spent by the mother on household chores, Q is the academic quality of the child, and Q_o is academic performance due to natural ability.

As we can see from this formulation, we assume that the mother is the one who decides for herself as well as the child's well-being. The mother faces two constraints.

The income constraint:

$$wt_w + y_o = px + (1 - D_1)C_m(t_m - t_{hh}) + (1 - D_2)C_{tt}t_l$$

where y_o is non-labour income, px is consumption of commodities, $C_m$is hourly wage rate of the domestic helper, w is market wage rate for market activity, t_w is the time spent by the mother at the market activity, t_m is the maximum time endowment of the domestic helper (subject to labour laws), t_{hh} is the time spent doing household chores, $C_{tt}$is the hourly wage rate of the private tutor, t_1 is the time spent by the private tutor, $D_1 = 1$ if no maid care is hired ($D_1 = 0$ otherwise), and $D_2 = 1$ if no private tutor is hired ($D_2 = 0$ otherwise).

The mother's income comes from her salary added to her non-labour income, which includes a portion of her husband's salary. Her expenses are dependent on her expenditure of commodities, px, which for convenience includes goods and services, and whether she hires a domestic helper and/or a private tutor.

The academic quality constraint:

$$Q = Q_o + (1 - D_2)q_1t_1 + [t_{wo} - t_w - (1 - D_1)t_{hh} - \text{rest}]q_2 - q_3t_3 + q_4t_4 + q_5t_5$$

where Q_o is natural ability, q_1t_1 is academic performance due to contribution of the private tutor, $[t_{wo} - t_w - (1 - D_1)t_{hh} - \text{rest}]$ is the time the mother spends with

her child, q_2 is the responsiveness of mother's contribution to the academic performance of her child, rest is the time spent by the mother on personal leisure, q_3t_3 is the negative total academic impact due to competing elements (artistic, musical, drama, dance), q_4t_4 is the total academic performance due to a sibling's coaching, and q_5t_5 is the total academic performance due to self-study.

The academic quality constraint is a function of how a child's time is apportioned to different studying opportunities: whether it be time spent with a tutor or parent or even self-study. The different q_i values represent the different responsiveness to academic performance by these various studying opportunities.

Forming the Lagrangean, we obtain:

$$L = \beta_1 \log (x - x_o) + \beta_2 \log (t_{wo} - t_w - t_{hh}) + \beta_3 \log Q -$$
$$\lambda [\frac{\mathrm{w}t_w + y_o - px - (1-D_1)C_m t_m - (1-D_2)C_{tt}t_1}{C_m} +$$
$$\frac{Q_o - Q + (1-D_2)q_1t_1 + (t_{wo} - t_w - rest)q_2 - q_3t_3 + q_4t_4 + q_5t_5}{q_2}]$$

We solve the Lagrangean by choosing the endogenous variables x, t_w and Q and solving the first-order conditions. We get two intermediate conditions to satisfy:

$$Q^* = \frac{\beta_3 q_2}{\beta_1 C_m} p(x - x_o)$$

The first condition shows that any additional increase in academic quality above natural ability, Q^*, is dependent on the mother's preference on which is more beneficial to her—her own consumption or her child's academic performance. The higher β_1 and C_m, the lower academic quality. Conversely, the higher β_3 and q_2, the higher academic quality.

$$Q^* = \frac{\beta_3}{\beta_2} [\frac{w}{C_m} - 1] q_2 (t_{wo} - t_w - t_{hh})$$

The second condition shows that any additional increase in academic quality above natural ability is positively related to the mother's preference for her child's academic quality, as well as the amount of leisure time ($t_{wo} - t_w - t_{hh}$) that she enjoys, but inversely related to her preference for leisure. The variables in square brackets give us a reservation wage, w^*, which a mother will self-determine whether she works more or consumes more leisure.

Solving for eight possible cases, the difference in a child's academic quality is presented in Table 1.

Sampling

The empirical testing was confined to three premier secondary schools in Singapore:[6] an all-girls school (Tanjong Katong Girls School), an all-boys school[7] (Anglo-Chinese School), as well as a mixed school (which serves as the control

Table 1. Comparisons of academic quality of children

Working mothers[a]	Case 2	Case 3	Case 4
Case 1	Adds quality associated with more contact time with mother Reduces quality due to wealth channelled on maid that could have gone into investment activities	Adds quality associated with more contact time with private tutor Reduces quality due to wealth channelled on private tutor that could have gone into investment activities	Adds quality associated with more contact time with mother Adds quality associated with more contact time with private tutor Reduces quality due to wealth channelled on maid that could have gone into investment activities Reduces quality due to wealth channelled on private tutor that could have gone into investment activities
Case 2		Adds quality associated with more contact time with private tutor Adds quality due to wealth channelled into investment activities instead of maid Reduces quality associated with less contact time with working mother Reduces quality due to wealth channelled on private tutor that could have gone into investment activities	Adds quality associated with more contact time with private tutor Reduces quality due to wealth channelled on maid that could have gone into investment activities
Case 3			Adds quality associated with more contact time with mother Reduces quality due to wealth channelled on maid that could have gone into investment activities
Non-working mothers[b]	Case 6	Case 7	Case 8
Case 5	Reduces quality due to wealth channelled on maid that could have gone into investment activities	Adds quality associated with more contact time with private tutor	Adds quality associated with more contact time with private tutor

Table 1. *Continued*

Working mothers[a]	Case 2	Case 3	Case 4
		Reduces quality due to wealth channelled on private tutor that could have gone into investment activities	Reduces quality due to wealth channelled on private tutor that could have gone into investment activities Reduces quality due to wealth channelled on maid that could have gone into investment activities
Case 6		Adds quality associated with more contact time with private tutor Adds quality due to wealth channelled into investment activities instead of maid Reduces quality due to wealth channelled on private tutor that could have gone into investment activities	Adds quality associated with more contact time with private tutor Reduces quality due to wealth channelled on maid that could have gone into investment activities
Case 7			Reduces quality due to wealth channelled on maid that could have gone into investment activities

[a]See Appendix B, Table B1 for actual variables. Case 1, working mother, no maid, no private tutor ($D_1 = 1$, $D_2 = 1$). Case 2, working mother, maid, no private tutor ($D_1 = 0$, $D_2 = 1$). Case 3, working mother, no maid, private tutor ($D_1 = 1$, $D_2 = 0$). Case 4, working mother, maid, private tutor ($D_1 = 0$, $D_2 = 0$).
[b]See Appendix B, Table B2 for actual variables. Case 5, non-working mother, no maid, no private tutor ($D_1 = 1$, $D_2 = 1$). Case 6, non-working mother, maid, no private tutor ($D_1 = 0$, $D_2 = 1$). Case 7, non-working mother, no maid, private tutor ($D_1 = 1$, $D_2 = 0$). Case 8, non-working mother, maid, private tutor ($D_1 = 0$, $D_2 = 0$).

group—Fairfield Methodist Secondary School). A total of 429 Grade 8 'Express' students from each school were chosen for the survey.[8] The Singaporean education system streams students at the end of Grade 6 and at Grades 8 and 10. The Grade 6 examination, known as the Primary School Leaving Examination (PSLE), is a common examination that groups students of similar ability and streams them into secondary schools of their choice: where they are further streamed according to 'Special', 'Express', 'Normal Academic' and 'Normal-Technical' classes. Schools themselves group students of similar ability, regardless of cultural differences,[9] in a classroom setting where they remain for two years through Grades 7 and 8 where each student takes the same subjects. After this, a streaming examination is conducted that will further group students in 'Science' or 'Arts' streams. The choice to elicit responses from Grade 8 students controls for certain school effects, such as those due to different streaming choices and different subject combinations. The homogeneity of students within classes is already predetermined by the schools upon enrolment at Grade 7. In this way, the implicit

assumption is that given students of similar ability, the variability of academic performance over the two years from Grades 7 to 8, is more likely due to factors outside the school. Ninety-four students were surveyed from Tanjong Katong Girls School, 159 students were surveyed from Anglo-Chinese School, and 176 students were surveyed from Fairfield Methodist Secondary School—of which, five students' responses were unused due to non-completed questionaires.

Results of Probit and Multiple Regression Analysis

We present the main home variables affecting academic performance that have been considered significant at the 90% confidence level under various home environments, and suggest various reasons for their significance, as well as provide recommendations for policy studies. The dependent variable—grade—is assumed to be a reasonably good indicator of academic rank across the students from the three schools because all schools test on the same subject combinations and usually grade on a curve. The following specification was used, as outlined by Rivers and Vuong (1988), in a simultaneous equation probit model as follows:

$$\text{GRADE} = \alpha_0 + \alpha_1 X_i + \alpha_2 \text{MAID} + \alpha_3 \text{MOTHERWORK} + \alpha_4 \text{MAID}^{\varepsilon} + \alpha_5 \text{MOTHERWORK}^{\varepsilon} + \varepsilon$$

$$\text{MAID} = \beta_0 + \beta_1 \text{WKHOURS} + \text{MAID}^{\varepsilon}$$

$$\text{MOTHERWORK} = \gamma_0 + \gamma_1 \text{MDYRS} + \gamma_2 \text{ALLOWANCE} + \text{MOTHERWORK}^{\varepsilon}$$

where X_i are home variables that are used to explain academic performance, MAID = 1 when a domestic helper is present (0 otherwise), MOTHERWORK = 1 when a mother works (0 otherwise), WKHOURS is the number of hours a day a mother works, MDYRS is the number of years a maid has worked in the family, and ALLOWANCE is the allowance that a mother gives to a child a month (this is taken as a proxy of how wealthy a family is).

The residuals are used in the regression to ensure that the null hypothesis of endogeneity of the dummy variables MAID and MOTHERWORK is rejected. Table 2 presents the estimates.

Several home variables are consistently significant over the various demographic groups. 'Travel time (hours)' a student takes to reach his/her school is also identified as a variable that has a negative relationship with grades. This suggests that there is a trade-off between going to a more prestigious school further away from and a neighbourhood school in the vicinity of the home. The number of 'negative factors' perceived by a child about his/her study environment is seen to have negative impact on grades. This suggests that indirect investment by the parents to make the home environment more conducive to studying or learning may not be effective in raising student grades. At most, it does not reduce grades. 'Time Spent at home' is also counted as a significant variable that has positive impact on grades. A student who spends more of his/her time at home is expected to have better grades than he/she would have had otherwise.

Contrary to *a priori* expectations, the sign of the variable 'time spent with a private tutor' is found to be negative.[10] This is a surprising result given that the students surveyed come from competitive schools and have roughly the same entrance scores to have been accepted into the school, thus limiting the nature debate.[11] The private tuition market in Singapore has long been thought to be

Table 2. Home variables affecting students' grades

	Overall (408), $R^2 = 0.095$	Overall (311) inclusive of qualitative parent attitudes, $R^2 = 0.131$	Overall (241) inclusive of gender dummy, $R^2 = 0.143$	Students without distinctions (289), $R^2 = 0.05$	Students with distinctions (119), $R^2 = 0.138$
Constant (grades)*	67.53 (23.38)	67.99 (17.77)	68.65 (18.16)	61.93 (24.31)	77.12 (18.87)
Gender dummy (0, boy; 1, girl)			−1.247 (−1.31)		
Presence of (0, absent; 1, present):					
Motherwork**	**3.99 (1.65)**	**4.68 (1.767)**	1.94 (0.53)	2.54 (1.16)	3.44 (1.23)
Maid**	−2.26 (−0.68)	−0.58 (−0.155)	−2.689 (−0.78)	−1.229 (−0.47)	−5.41 (−0.47)
Tutor	−0.868 (−0.78)	−0.207 (−0.14)	−0.10 (−0.078)	−0.236 (−0.232)	−0.91 (−0.865)
Home variables					
Time spent with private tutor (t_1)	−0.303 (−1.148)	**−0.63 (−1.745)**	−0.34 (−1.22)	−0.097 (−0.416)	−0.266 (−1.032)
Time devoted to competing elements (t_3)					
Computer hours	−0.034 (−0.16)	−0.163 (−0.64)	0.167 (0.57)	−0.063 (−0.296)	−0.129 (−0.779)
Investment hours into the Arts	0.043 (0.294)	0.121 (0.722)	−0.077 (−0.46)	0.088 (0.708)	**0.335 (1.91)**
ECA hours	−0.282 (−1.01)	−0.45 (1.36)	0.287 (0.81)	−0.22 (−0.868)	−0.117 (−0.46)
Time devoted to (t_5) studies					
Study hours a day	−0.348 (−0.98)	−0.317 (−0.71)	0.009 (0.02)	0.092 (.287)	−0.455 (−1.267)
Last minute study hours	−0.03 (−0.098)	−0.004 (−0.01)	−0.114 (−0.31)	0.145 (0.51)	0.137 (0.467)
Homework hours a day	0.047 (0.11)	0.099 (0.18)	−0.56 (−1.072)	0.482 (1.268)	−0.04 (−0.103)
Mother's attitude (1, very encouraging; 4, very discouraging)		0.238 (0.38)			
Father's attitude (1, very encouraging; 4, very discouraging)		**−1.19 (−2.124)**			
Home environment					
Negative factors	**−1.16 (−2.44)**	**−0.93 (−1.71)**	**−1.37 (−2.39)**	−0.599 (−1.433)	**−0.964 (−1.733)**
Positive factors	−0.43 (−1.40)	−0.435 (−1.19)	**−0.669 (−1.73)**	**−0.55 (−1.99)**	−0.409 (−1.37)
Time spent at home (1, very seldom; 4, very often)	**0.949 (2.26)**	**1.154 (2.21)**	**0.842 (1.70)**	.482 (1.268)	−0.378 (−0.925)
Travel time (hours)	**−3.65 (−3.41)**	**−4.657 (−3.71)**	**−3.41 (−2.79)**	**−1.61 (−1.722)**	−0.72 (−0.60)
Wealth proxy—allowance	−0.029 (−0.08)	0.158 (0.33)	−0.14 (−0.32)	0.048 (0.14)	0.362 (0.924)

Table 2. *Continued*

	Overall (408), $R^2 = 0.095$	Overall (311) inclusive of qualitative parent attitudes, $R^2 = 0.131$	Overall (241) inclusive of gender dummy, $R^2 = 0.143$	Students without distinctions (289), $R^2 = 0.05$	Students with distinctions (119), $R^2 = 0.138$
Probit residuals					
Maid$^{\varepsilon}$	3.53 (1.046)	1.28 (0.34)	4.45 (1.283)	–0.405 (–0.153)	5.837 (.505)
Motherwork$^{\varepsilon}$	**–4.299 (–1.81)**	**–5.143 (–1.99)**	–2.23 (–0.609)	–2.78 (–1.31)	**–3.654 (–1.648)**

Figures in parentheses represent *t*-ratios. Bold data are coefficient estimates deemed significant at the 90% confidence level or above.

'Time devoted to competing elements—computer hours' refers to the number of hours spent on the computer a day. 'Time devoted to competing elements—investment hours' refers to the number of hours spent on music, dance, drama and foreign language instruction in a week. 'Time devoted to competing elements—ECA hours' refers to the number of hours on non-mandatory and mandatory extra-curricular activities organized by the school in a day.

'Time Spent with Private Tutor (t_1)' would most likely have a positive effect on the subject grade, but its effect on the overall grade is much more open to speculation. Since the Singapore school system focuses more on overall ability rather than just subject-specific ability, it is postulated here that more tuition hours may actually have a detrimental effect on overall academic performance. This is suggested to be the case by the negative coefficients.

'Last minute study hours' is defined as the number of hours a student studies the day before a test.

'Father's attitude' and 'Mother's attitude' are used as a proxy for time spent by mother with the child: $[t_{wo} - t_w - (1 - D_1)t_{hh} - \text{rest}]$, and was a subjective rank given by the respondent on his/her perception of a mother's or a father's attitude towards the child's performance. Four descriptive adjectives were used to elicit responses: very encouraging, encouraging, neither encouraging nor discouraging, or discouraging.

'Home environment-negative factors' is a variable ranked according to a scale of 1 to 5, which the respondent needs to identify using five descriptive adjectives like noisy, stuffy, unfriendly, uncomfortable, and busy. Students were also asked to evaluate their home environment based on five positive qualitative factors: quiet, air-conditioned, friendly, comfortable, and relaxed.

'Travel time (hours)' refers to the time it takes for a student to go from his/her house to school.

'Allowance' is a proxy for wealth and is ranked according to a scale of 1 to 4: '1' when under S$50 a month; '2' when S$51–99 a month; '3' when S$100–150 a month; and '4' when above S$150 a month.

under a free-market system. Due to the unhindered supply and demand for private tutors, the equilibrium price for tuition and the supply of good tutors should be determined by the market. One would expect that greater time spent with a tutor should improve grades given that students within the sample are of similar ability. This paper does not try to imply causality in this relationship, but highlights that certain imperfections may exist within the tuition market in Singapore. By introducing a gender dummy (refer to column 3 in Table 2), we compare the differences between males and females within the sample group.[12] The coefficient of the gender dummy is relatively small and insignificant, therefore suggesting equal opportunity for the sexes within the Singapore education system. This needs further research with a larger sample size. In examining the impact of 'parental relationship' factors[13] on academic performance (refer to column 2 in Table 2), the results show that while a mother's attitude to studies may not necessarily have any influence on the outcome of grades, a father's discouraging attitude is negatively related to the academic performance of a child: the more negative, the worse his child's performance.

Controversial variables

Across subcategories, it is apparent that the presence of certain variables may not necessarily be bad or good. The variables 'study hours a day', 'last minute study hours', 'homework hours a day', and 'computer hours' are all variables that are not significant in this study. Yet they traditionally play a critical role in formulating education policy in schools and dictating education decisions in the minds of parents. This study opens the debate to questioning the usefulness of traditional wisdom in dictating education policy. This is not a new insight. Auerbach (1989) found links that indirect factors including frequency of children's outings with adults, number of maternal outings, emotional climate of the home, amount of time spent interacting with adults, level of financial stress, enrichment activities, and parental involvement with the schools had a stronger effect on many aspects of reading and writing than did direct literacy activities.

Several key home variables identified as significant are more qualitative in nature: 'travel time (hours)', 'negative factors in the home', 'time spent in the home', and 'father's attitude'. This result has been well documented in other studies. The US Department of Education (1997) studied how specifically fathers' involvement in their childrens' academic pursuits affected grades, and their results showed a significant positive relationship. Other studies have examined how these qualitative factors impact academic performance (see Stafford, 1974; Behrman, 1980).

A key home variable suggested in the analysis is the dummy variable: a mother's choice to work, which seems to positively impact academic performance. As explained earlier, this may be due to the fact that most mothers in Singapore do not, in their spare time, attempt to raise their child's academic performance; rather, they find suitable or capable substitutes in the form of private tutors or other investment activities (Quah, 1993). As suggested earlier, this implies that their own preference for leisure (rest) must be very high or their perception of their own quality contribution to their child's academic performance (t_3) very low. This added income from working, without the disutility associated with household chores, allows a mother to use this money to invest in a child to raise academic performance.

Students with Distinctions

Sampling only students who received distinctions in their final-year examinations shows that the majority of the variables earlier identified as significant for other demographic groups have no effect when tested against this sample. 'Time spent with a private tutor', 'travel time (hours)', 'presence of mother working', and 'time spent at home' all have no significant effect when tested. Like the other demographic groups, the amount of 'negative factors' perceived by the child in his/her study environment impacts negatively on grades. A variable that affects grades positively is 'time devoted to competing elements—investment hours into the arts. This variable is only significant in this particular sample. It suggests that only high achievers are able to benefit from increased investment in the arts. For lower achievers, such investment may not impact grades at all (refer to column 4 in Table 2).

Qualitative factors

Although only a small sample of 80 students had their qualitative characteristics assessed by their form teachers, results point to areas where further research can be done. Each respondent had at least one year's association with their wards to assess them. Each quality attribute had five levels of rating: Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, or Strongly Disagree.

The results of the regression hint that these qualitative factors may be more significant than previously attributed (Table 3). From the aforementioned, all levels of 'obedience' and 'health' have no effect on grades. However, students who are outstanding in 'creativity' and who exhibit outstanding 'sociability' seem to suffer lower grades. This suggests that such students may have engaged in activities that take time away from their studies. Only a very strong background in 'general knowledge' seems to aid in increasing grades.

Conclusion

This paper examines how new home variables in Singapore affect a child's overall academic performance. The effects of longer 'travel time (hours)' to get to school or more 'negative factors' associated with the home have been shown to negatively affect grades, as established in the literature. What is then surprising is the effect of tutors on academic performance. Contrary to national perceptions, the results suggest that having a private tutor may be counter-productive in the Singapore setting. Again it is believed that excessive studying in the Singapore context may have resulted in diminishing returns. The potentially positive influence of a private tutor over one subject's grades does not seem to spillover to other subjects. Instead, time taken away from those subjects may lead to a decline in the overall academic performance as suggested by this study. The presence of a domestic helper in the home has an insignificant impact on grades. If a mother chooses to work, it would seem that there are spillover effects that benefit a child's academic performance. This study asserts that how a child performs academically is less dependent on his/her choice of time use, or the number of benefits he/she receives via artistic, social or cultural pursuits. Except for the exceptional student, such investment does not seem to spillover to help overall academic performance. The conventional wisdom of 'the more the better' in terms

Table 3. Qualitative factors affecting students' grades (random sampling of 80 students from Anglo-Chinese School [Ind] and Tanjong Katong Girls School)

	Sample students graded on qualitative factors (80), $R^2 = 0.357$
Constant (grades)	71.94 (5.995)
Qualitative factors	
Obedience	
Outstanding	0.757 (0.11)
Above average	–3.97 (–0.548)
Average	–6.31 (–0.838)
Less than average	–3.20 (–0.385)
Health	
Outstanding	–4.96 (–0.716)
Above average	–4.63 (–0.688)
Average	–5.65 (–0.786)
General knowledge	
Outstanding	20.51 (2.12)
Above average	9.72 (1.07)
Average	6.39 (.724)
Creativity	
Outstanding	**–12.53 (–1.84)**
Above average	–4.66 (–0.828)
Average	–3.30 (–0.625)
Sociability	
Outstanding	**–10.67 (–2.22)**
Above average	–2.48 (–0.696)
Average	–1.21 (–0.362)

Figures in parentheses represent *t*-ratios. Bold data represent coefficients significant above the 90% confidence level.

of tutoring, computer accessories, and so on, is refuted by the results of this study, arguing instead that diminishing returns set in far quicker when over-investment in the child takes place.

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Notes

1. Singapore's wage policy has been designed to reflect a 'higher wage' emphasis, especially in the public sector to reconcile wages with the private sector. Now the opportunity cost of remaining in the home is rising through these provisions. (More women therefore substitute their time in the home for time in the marketplace.)
2. Figures were computed using statistics derived from the *Report on the Labour Force Survey of Singapore* published by the Ministry of Labour (1994, 1997). Using the base year October 1992–September 1993, the gross figures were deflated to derive growth rates in real terms.

3. Tax incentives have been introduced like the Enhanced Child Relief was introduced in 1985. Under Enhanced Child Relief, all working mothers who had at least five 'O'-level passes were entitled to tax relief: 5% for the first child, 10% for the second child and 15% for the third child on the mother's income. In 1988, this scheme included the fourth child as well, and the requirements were reduced to women with three 'O'-level passes. This encourages the hiring of maids since working mothers will find it harder to take care of more children.
4. In one study (Leibowitz, 1974b), it was found out that the longer a mother spends with her child, the better were her child's grades. This loss of contact therefore has a negative impact on grades.
5. This approach was first used by Michalopoulos *et al*. (1992) and subsequently commented on by Kooreman and Wunderink (1996)
6. These schools were chosen because of the need to hold natural ability constant in our survey. It was hoped that by choosing on average three similar schools, with students of similar natural ability, we may be able to see the effects that investment and nurture, without taking into account the nature debate, have on academic performance.
7. Choosing an all-boys school and all-girls school allows us to be able to compare the effects that gender has on academic performance among boys and girls or whether they are significantly different from a mixed school.
8. Appendix A, Table A1, highlights key demographic data from the three sample groups as well as overall.
9. The role of culture on grades has been extensively covered in the literature (see, for example, Jencks and Phillips, 1998; Cook and Ludwig, 1997). Singapore is unique in this regard because of its observance of meritocracy in its grading procedures. Regardless of race, only students who satisfy a high level of standards are allowed into premier schools. In this regard, the issue of cultural equity is sidestepped to one of academic excellence. To an extent this does border on the subject of academic racism, as neighbourhood schools do find a cultural mix where all other races except the Chinese are represented disproportionately higher than the national average, whereas academically more rigorous schools find the number of other races compared with the number of Chinese students to be disproportionately lower than the national average.
10. Ordinary least-squares estimation was run to determine whether this negative relationship still held between grades and tuition hours by partitioning the data-set into three samples: (1) students who take between one hour and less than three hours of tuition per week; (2) students who take between three and 5.5 hours of tuition per week; and (3) students who take more than 5.5 hours of tuition per week. In samples 1 and 2 both had strongly significant negative results, while in sample 3 a strongly significant positive result was obtained.
11. The issue of nature versus nurture is under debate here. Is it because bad students need longer tuition hours? Or is it that longer tuition hours result in diminishing returns to studying? The sample used in this study is students from academically rigorous schools and whose selection criteria of its intake are highly selective, utilizing a nationally graded examination, the PSLE. Scores from this sample are highly homogeneous based on the PSLE marks given.
12. Only 247 completed surveys distinguished the respondent as either male or female.
13. This cannot be conclusively determined through this sample, as most of the student's from Anglo-Chinese School (Ind) failed to answer the question about their fathers' attitudes towards their studies.

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Appendix A

Table A1. Summary statistics for various schools

	Fairfield	Tanjong Katong Girls School	Anglo-Chinese School (Ind)	Combined
Number of students surveyed	176	94	159	429
PSLE score of students[a]	244–264	237–275	241–272	237–276
Mean average overall Secondary 2 grade (marks)	67.5	63.1	65.6	65.8
Median overall Secondary 2 grade (marks)	68.2	63	66	66
Number of students with maids (%)	23.9	28.7	56.6	37.1
Number of students with private tutors (%)	52.8	50	68.6	58
Number of students with working mothers (%)	55.7	57.4	62.9	58.7
Average computer usage a day (hours)	1.9	1.5	2	1.8
Average television usage a day (hours)	3.1	4	2.8	2.8
Average homework hours a day (hours)	1.6	1.8	1.6	1.6
Average study hours a day (hours)	1.5	1.8	1.8	1.8
Hours spent studying before a test (hours)	2.6	3.2	2.4	2.4
Average number of books read a week (books)	1.8	2.1	1.6	1.6
Average number of hours spent in ECA (hours)	2.1	1.9	1.9	1.9
Average travelling time to school (min)	25	34	30	30

[a]These numbers represent the school's overall lowest and highest accepted PSLE scores. Students are further grouped in classes with even greater homogeneity.

Appendix B

Table B1. Comparisons of academic quality of children among working mothers

	Case 2	Case 3	Case 4
Case 1	$+B_3q_2\bar{w}^*t_{hh}$	$+B_3q_1t_1$	$+B_3q_1t_1$
			$+B_3q_2\bar{w}^*t_{hh}$
	$-B_3q_2t_m$	$-(B_3q_2C_{tt}t_1)/C_m$	$-B_3q_2t_m$
			$-(B_3q_2C_{tt}t_1)/C_m$
Case 2		$+B_3q_2\bar{w}^*t_{hh}$	$+B_3q_1t_1$
		$+B_3q_1t_1$	
		$-B_3q_2t_m$	$-B_3q_2t_m$
		$-(B_3q_2C_{tt}t_1)/C_m$	
Case 3			$+B_3q_2\bar{w}^*t_{hh}$
			$-B_3q_2t_m$

Case 1, working mother, no maid, no private tutor ($D_1 = 1$, $D_2 = 1$). Case 2, working mother, maid, no private tutor ($D_1 = 0$, $D_2 = 1$). Case 3, working mother, no maid, private tutor ($D_1 = 1$, $D_2 = 0$). Case 4, working mother, maid, private tutor ($D_1 = 0$, $D_2 = 0$).

Table B2. Comparisons of academic quality of children among working mothers

	Case 6	Case 7	Case 8
Case 5	$-B_3q_2t_m/(B_1 + B_2)$	$+B_3q_1t_1/(B_1 + b_2)$	$+B_3q_1t_1/(B_1 + B_2)$
		$-(B_3q_2C_{tt}t_1)/(B_1 + B_2)C_m$	$-(B_3q_2C_{tt}t_1)/(B_1 + B_2)C_m$
			$-B_3q_2t_m/(B_1 + B_2)$
Case 6		$+B_3q_1t_1/(B_1 + B_2)$	$+B_3q_1t_1/(B_1 + B_2)$
		$+B_3q_2t_m/(B_1 + B_2)$	
		$-(B_3q_2C_{tt}t_1)/(B_1 + B_2)C_m$	$-(B_3q_2C_{tt}t_1)/(B_1 + B_2)C_m$
Case 7			$-B_3q_2t_m/(B_1 + B_2)$

Case 5, working mother, no maid, no private tutor ($D_1 = 1$, $D_2 = 1$). Case 6, working mother, maid, no private tutor ($D_1 = 0$, $D_2 = 1$). Case 7, working mother, no maid, private tutor ($D_1 = 1$, $D_2 = 0$). Case 8, working mother, maid, private tutor ($D_1 = 0$, $D_2 = 0$).