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FAMILY BACKGROUND, SCHOOL SYSTEM AND ACADEMIC ACHIEVEMENT IN GERMANY AND IN JAPAN

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Abstract

This paper investigates why the effect of family background on student's educational achievement is so different in Germany and in Japan in spite of their similarity over a huge variance of student performance scores in the PISA 2003 study. We intend to clarify the factors which produce the difference and the similarity simultaneously. For this purpose, we analyzed the PISA 2003 data of both countries. The strong tracking system with early stage selection and with grade retention in Germany, and the entrance examination system in Japan contribute to produce the difference and similarity of student's test performance in the two countries. In addition, we found that the role of the mother in the family, connecting family background and student performance, differs according to each school system.

Keywords

PISA; academic achievement; educational inequality; tracking system; Germany; Japan

1. Introduction*

Educational attainment is deeply influenced by family background in modern society (Shavit and Blossfeld, 1993). To a varying degree academic achievement has played an important role in this attainment process. Because students from an advantaged social background show better academic performance than those from disadvantaged, the influence of academic achievement on educational attainment is clear. Boudon saw this process as a primary effect of class background in his classic work (Boudon, 1973). The purpose of this research is to carry out a comparative analysis of the influence of family background on academic achievement in Germany and in Japan. Using PISA2003 data, we focus on how the educational achievement process varies in different social and institutional contexts.

Germany and Japan share some common results in PISA outcomes. First, a variance in student's performance is large in Germany and also in Japan. Pisa test scores are standardized with 500 averages and with 100 as a standard deviation based on students' test results of the OECD member countries. In most countries, standard deviation of test score is less than 100, whereas that in Japan and in Germany exceeds 100. Low within-school variation and high between-school variation in test performance are another common aspect of two countries. Germany and Japan have a highly stratified secondary school system, which results in low-within and high-between school variations.

But PISA results in Japan are different from those in Germany on other aspects. The most prominent difference between two countries is the test score itself. Whereas the average test score of the German students is a little bit higher than the OECD average, the average test score of Japanese students is among the highest scoring countries of all OECD members. In addition, the two countries are quite different in the relationship between family background and students' test performance.

The regression analysis of math test scores on the family socio-economic status shows that 'Germany and Japan have a similar slope with one unit of difference on the socio-economic scale corresponding to 47 and 46 score points, respectively. However it also indicates, in Japan, there are many exceptions to this general trend so that the relationship explains 12 per cent of the performance variation, while in Germany student performance follows the levels predicted by socio-economic background more closely, with 23 percent of the performance variation explained by socio-economic background (OECD, 2004a, p181)'.

PISA Shock on Germany guided a lot of research to investigate the factors that influence German students' test performance. In such research, the disadvantaged family position of immigrant students and the structure of German educational system (retention and early start tracking) are seen as factors that produce students' poor outcomes and its strong relationship with family background in Germany. Especially, the traditional three-tier school tracking system starting after 4^{th} grade is an institutional factor which most researches have focused on (Ammermüller 2004, 2005; Jürges and Schneider 2006; Michaelowa and Bourdon 2006; Hanushek and Wößmann 2006). Here, we discuss this problem from a comparative perspective.

In a comparison between Germany and Japan, we must consider the problem of out-of-school studies including shadow education (Stevenson and Baker 1997; Bray 1999; Baker et.al. 2001). For the countries in East Asia, such as Japan, South Korea, China, and Taiwan, entrance examination plays

* We are grateful to Dr. Jaap Dronkers for giving us the opportunity to conduct this collaborative research. During our stay in Florence from 2006 to 2007, Ojima was a visiting fellow at RSCAS, and received a research grant from the Overseas Research Program of Doshisha University and from the Japan Economic Research Foundation. von Below was a Jean Monnet Fellow at the RSCAS and on leave from her position as Assistant Professor at the Social Science Department, Johann Wolfgang Goethe University, Frankfurt am Main. From 2007, Grant-in-Aid for Scientific Research has enabled us to continue this research.

a crucial role in the admission process to higher education. In these societies many students use out-of-school education and spend much time on it for exam preparation. A pervasion of out-of-school education alters the relationship between family background and academic achievement because the strategy of parents for their children's education varies based on such educational circumstances.

In this paper, we analyze the influence of family background and the school system which produce these differences between Germany and Japan. In addition, we focus on the intra-family factors that create the relationship between family background and students' performance, especially on the difference between mother's roles in the two countries.

2. German and Japanese Education System

School systems in Germany and in Japan are quite different after 4th grade. Japanese students learn for 6 years at primary school and 3 years at junior high school both of which teach students in a comprehensive setting. Most German students choose to go to a different type of secondary school after 4th grade, at age 10. The school experience of German students varies even in early teens. We will begin by introducing the secondary school system in the two countries.

German secondary schools are classified into three kinds; Gymnasium (grammar school), Realschule (intermediate school) and Hauptschule (general school). German students learn at Grundschule (primary school) and proceed to one of these kinds of school. Most of the students who receive Abitur, which is a qualification for universities, graduate from Gymnasium. Realschule provides opportunities for higher education, other than universities, and preparation for white-collar jobs. Compared to Gymnasium and Realschule, Hauptschule graduates have quite limited opportunities to access to higher education and to white-color jobs. In addition to these types of schools, Germany has a comprehensive secondary school, Gesamtschule. Although some of comprehensive schools provide Abitur for students, they occupy a very small portion of secondary school students who receive Abitur. Its influence is very limited (Schnepf 2002, 2003).

This tripartite tracking system in Germany is considered an important institutional factor influencing intergenerational transmission of social inequality. The effects of social origins on secondary school choice are very strong. Compared with parent's occupation and family income, parent's education is more effective predictor of children's school choice (Schnepf 2002; Schneider 2008). This choice, in turn, affects future educational and occupational attainment. In addition, children's earning differentiation in later life, in part, stems from the relationship between parent's background and their secondary school choice (Dustmann 2004). Secondary school placement is decided based on primary school teacher's recommendation on grounds of student's ability, but parent's preference influences this placement irrespective of student's ability. As a result, German secondary school tracks are highly stratified according to students' academic achievement and to their background.

In contrast to German secondary school system, all Japanese upper secondary schools, or senior high schools, provide an opportunity to enter higher education. Their diploma qualifies for admission to all higher education institutions. Senior high schools are divided into two major tracks institutionally; general academic track (Futsu-ka) and vocational track (Senmon-gakka). Though students who graduate from any type of high school are qualified to advance to higher education, students graduated from general academic tracks have an advantage to access to higher education over those graduated from vocational tracks. At present, more than 70 per cent of students choose the general academic track. Japanese high schools are stratified based on their graduates' advancement to higher education, especially based on graduate's placement to the prestigious universities. Highly ranked schools select students with high academic performance through the use of their entrance examination and of their junior high school records. In this way, Japanese high schools are also highly stratified as to students' academic ability.

To clarify each school's position in the high school stratification system, we classify general academic high schools into three ordered categories according to their higher education advancement ratio. Because we do not have any information about higher education advancement rate of each high school in the PISA sample, schools are classified based on

Table 1. Classification of Japanese General High School

	Students' Educational Expectation
General-A	University > 80% and All Students' expectation is and above
General-B	University + Junior College> 80% Including 'High School' expectation level students.
General-C	General Course which are not classified as General-A and General-B

students' educational expectations, rather from the graduate's advancement rate in each school. Table 1 shows features of each category. We named high schools with the highest students' educational expectations as General-A. Over 80 percent of students in General-A schools expect to complete universities. Schools with intermediate students' expectation are classified as General-B. 80 per cent or more students in General-B schools expect to complete at least junior college. The remaining high schools are classified into General-C. Not only students who want to apply for universities or junior colleges, or professional training schools (Senshu Gakko), but also students who get a job immediately after graduation are enrolled in this type of high school. Students attending General-C schools have a huge variety of career aspirations. In this analysis, Japanese high schools are classified into three types of general academic track high schools and one type of vocational high school[1].

3. Basic Structure of Tripartite Relationships –SES, School and Math Performance

First, we focus on math performance and on family background of students from each school type. Figure 1a indicates school's average of students' math test scores and of their socio-economic background (ESCS, the index of socio-economic and cultural status, developed by OECD PISA project) in Germany. Schools are categorized into four groups (Gymnasium, Realschule, Hauptschule and Gesamtschule) and are indicated by different shape of dots. Schools' math performance average and their socio-economic background score are highly correlated (r=.830). This figure shows clear differences between four types of school. Gymnasium shares top status in math scores and in socio-economic background. Realschule follows Gymnasium and Hauptschule follows Realschule. Gesamtschule is scattered around grand mean of each score. In Japan, we can find the same relationships as in Germany.

1 Rohlen's monograph on Japanese senior high school system describes its features very well (Rohlen, 1983).

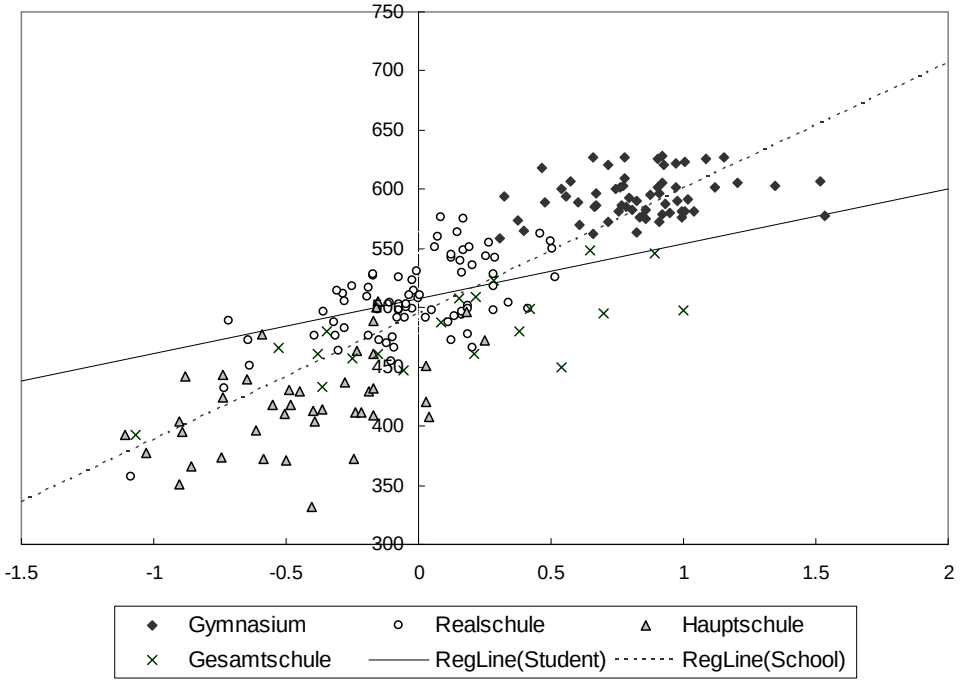

Figure 1a. Socio-Economic and Cultural Status and Math Score (School Mean : Germany)

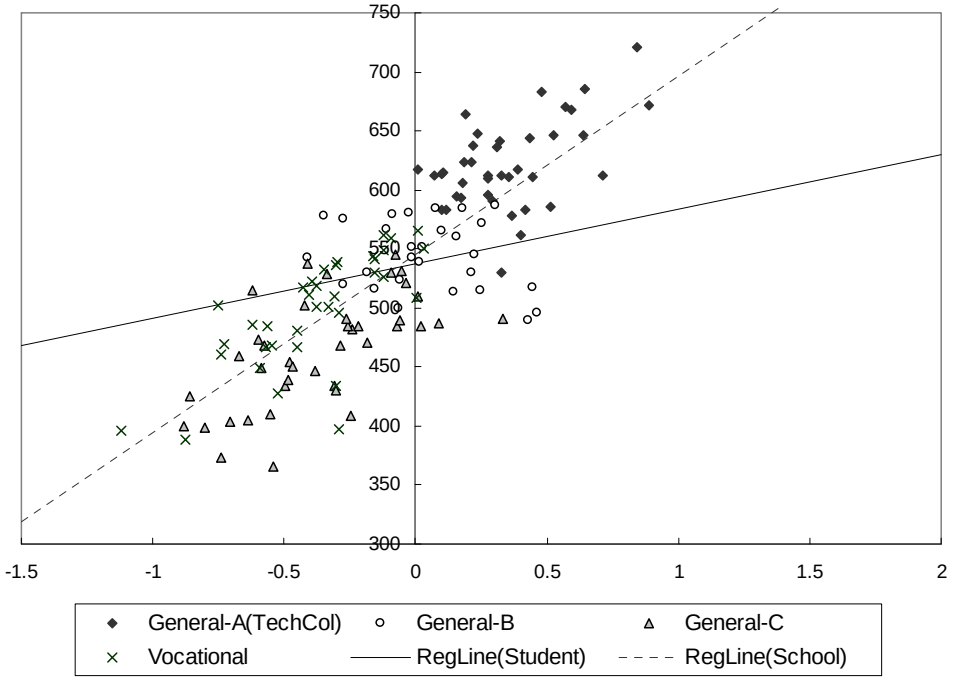

Figure 1b. Socio-Economic and Cultural Status and Math Score (School Mean : Japan)

A correlation between schools math performance and their average socio-economic background is .816. General-A schools occupy the top status on math performances and also on socio-economic

background. General-B schools follow General-A. Socio-economic background positions of General-C schools and of vocational high schools do not differ. But average math scores of vocational high schools are a little bit higher than those of General-C schools as a whole.

If we focus on the variation of each school type, we can recognize differences between the two countries. As indicated in Figure 1a and 1b, math test scores' variation of the top ranked schools in Japan is greater than that in Germany. Standard deviation of school average math test scores in Gymnasium is 18.4 compared to 37.6 in General-A schools. Top ranked schools in Germany show the same degree of math performance, whereas top ranked schools in Japan have a big variety of math score averages[2]. The variation between schools in other categories shows less variation. Standard deviation of school averages range between 37.8 and 42.9 in Germany and between 29.7 and 47.5 in Japan. The difference in top ranked schools illustrates the different features of educational environments in the respective countries, as we will discuss later.

Two regression lines are drawn in each figure. The solid line is a regression equation line based on individual students. A dashed line indicates that based on school averages. Germany and Japan have a similar slope based on individual students as PISA has already reported. But the slope of regression lines based on Japanese schools is steeper than that based on German schools; its gradient is 151 and 106 respectively. This result shows that Japanese high schools are highly stratified along the students' academic ability.

Preceding the detailed analysis, we should understand the basic structure of relationships between socio-economic background and school status relating to students' math performance. Figure 2 shows a path diagram illustrating the relationship between socio-economic status and math scores. School type is measured by average student's math test scores of each type of school[3].

This figure clarifies the features of these structures in two countries. We can observe strong relationships between socio-economic status and school type, and between school type and students' math performance. The path coefficient between socio-economic status and school type is stronger in Germany than in Japan.

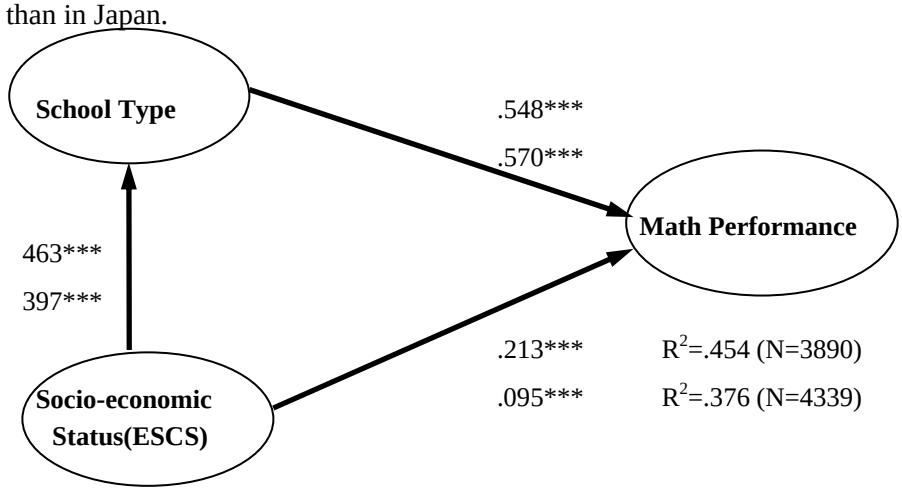

Figure 2. Basic Relationship between Socio-economic Status(ESCS) and Students' Math Performance

(1) Standardized Regression Coefficient (2) Upper Row= Germany / Lower Row =. Japan (3) School Type is measured by the mean of students' math test scores. (4) ESCS= the Index of Socio-Economic and Cultural Status

2 Standard Deviation of school average socio-economic status (ESCS) is not so different between General-A (.21) and Gymnasium (.25).

3 In this paper, all estimates of the coefficients and of standard errors are calculated by the WesVar5.1. (OECD 2004b, Westat 2007)

The coefficient from school type to students' math performance is slightly weaker in Germany than in Japan. As a result, the degree to which socio-economic background relates to students' performance via school type in Germany is as much as that in Japan, .254 and .226 respectively. Secondly, a direct path from socio-economic status to math performance in Germany is twice as much as that in Japan. Even after controlling by school type average, students' socio-economic background still has considerable effect on math performance in Germany[4]. The indirect relationship between socio-economic status and students' math performance according to school type is slightly stronger in Germany than in Japan. The direct path from socio-economic status leads to a difference in total linkage between family background and student's academic performance[5]. In the next section we explore factors related to this process.

4. School System and Family Background

Based on cross-country comparisons of variations in educational outcomes of primary and secondary schools, Hanushek and Wößmann (2006) showed that the early tracking system increases educational inequality. It means that early tracking countries increase the variance of test scores from primary school to secondary school. Germany is a typical country in that it has this feature. Although the variation of test scores in Germany at 4th grade (at 10 years old) is lower than the international average, at age 15 it is highest between 18 countries. If this increase is related to family social background, early tracking contributes to the reproduction of social inequality[6].

Socio-economic status and student's math performance is strongly correlated in Germany. Germany is included in the top five countries in which students' performance variation is attributable to their background variables. On the contrary, Japan is ranked at near the bottom in its correlation (OECD 2004a). Based on our analysis, the effect of socio-economic status on academic performance (in math) depending on school type is not necessarily stronger in Germany than it is in Japan. This shows the strength of this relationship in Germany does not result from school characteristics such as these measured by the average math performance of students. To investigate other possible factors, we introduce three variables in addition to socio-economic status and school type. Grade, mother's current job status and out-of-school study hours are incorporated to the regression model to investigate these functions in the academic achievement process.

Repeating the same grade is rarely seen in Japanese secondary schools. All Japanese students in PISA2003 samples are in the 10th grade. But German students' grade varies between 7 and 11. Many German students below 10th grade experienced repeating a grade. 81 per cent of 7th grade students have repeated the same grade. 72 per cent of 8th grade students and 7.2 per cent of 9 grade students also have repeated at least a year. We estimated the effect of grade on math performance and testify its function to mediate between socio-economic status and students' performance. Grade measured by the deviation from 10th grade is added to the base line model first.

Women's participation in the labor force has increased in many countries. At the same time, women's family role in child-raising is still given greater importance than men's. Does the mother have a role in promoting child's academic performance? To test this, we add the mother's job status to our model. If mother has an influence on child's math performance in family life, we can expect significant effect from mother's current job status. Those mothers who can spend much time with the family should be expected to have more influence on her children than those who have work

4 If we use each school average instead of school type average, a direct path from socio-economic background in Japan is almost zero. However, in Germany, it is still statistically significant and has some predictive power (.147).

5 We cannot deny the possibility that this direct path may derive from indirect path which is not measured by this model.

6 Strakova (2007) points out that Czech's tracked education system strengthens the relationship between socio-economic status and students' academic performance in comparison to Nordic countries and Canada.

commitments. The mother's job status is divided into three categories, full-time worker, part-time worker and no occupation. In the regression model, we analyze the effect of part-timer dummy and that of no-occupation dummy on her child's math performance.

Study hours outside school offer another possibility to mediate family background with math performance, especially in a society which has a highly developed shadow education system (Stevenson and Baker 1992; Bray 1999; Baker et al. 2001). Outside school study including shadow education improves student's academic performance. Based on the results from 11th grade Japanese high school student surveys conducted in 1979 and in 1997, Kariya (2000) found that after-school study hours are affected by socio-economic status and that its effect has increased over the 18 years. Hours of homework, those of out-of-school study and those of other study are summed up measure study hours outside school[7]. We investigate this problem in the final section.

Table 2 and Table 3 show five regression models for this series of analysis. Model 1 is a baseline model that uses only gender and socio-economic background as explanatory variables. Three school dummy variables are added to Model 2. Model 3 includes grade as an explanatory variable. Model 4 includes mother's job status dummy variables in addition to Model 3, and interactions between mother's job status and socio-economic status are added in Model 5.

The first two models represent the basis of our analysis. Based on these models, we can outline some features of academic achievement in both countries. With regard to socio-economic status, the regression coefficients of both countries are almost equal but its relationship is different as we have noted. Male students show better performance in both countries. Gender difference is greater in Germany than in Japan. After controlling by three school dummies, boys show 14 points increase in Germany in contrast to no increase in Japan. In consequence, boys in Germany achieve nearly 30 points over girls in the same type of schools[8].

Figure 1a and 1b indicated the student's math achievement is quite different between each school type. The results of model 2 show school type distinction clearly. In Germany, Gymnasium students achieve 147 points over Hauptschule students. In Japan, General-A school students score 144 points higher than General-C school students. Other types of school rank between the two extremes. As we recognized by the path diagrams in Figure 2, socio-economic status still has significant effect on math performance in both countries even after controlling for school type dummies. This model also confirms that SES's direct effect is stronger in Germany than Japan.

In the following section, we will investigate the effect of grade, mother's role in the family, and out-of-school study on students' academic achievement.

4-a. Grade

We analyze grade only with German students, because all Japanese students in PISA are in the tenth grade. Let us focus on Model 3. Compared with Model 2, R^2 increases .067 and the coefficient of grade indicates 40. One grade promotion results in a sizable increase in math test scores. Not only type of school, but also grade in the same school type still makes students' math performance differ significantly. As an average test score increase with student's grade in every school type, grade's influence exerts on student's performance independent of school types. In addition, the coefficients of other variables except for gender go down. The coefficients of three school dummies are reduced between 12 and 17 points, and that of socio-economic status decreases more than 3 points. This shows school type effect is partly derived from the difference of grade composition in each school type. The

7 We did not include study hours of tutors because it correlates negatively with math test scores in most countries, even in Japan. Parents whose child shows poor academic performs are inclined to use a private tutoring.

8 Although male superiority is found in all school types in Germany, we can find such superiority only in the highly ranked schools in Japan. This finding is interesting, but it is not our present concern.

decrease of socio-economic status implies another function of grade. Grade plays an intermediate role between socio-economic status and math performance.

Table 2. Regression Analysis of Predicting Student's Math Performance (Germany)

	Model 1				Model 2			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	501.809	3.177		***	418.438	6.962		***
Gender (Male=1, Female=0)	15.417	3.437	0.082	***	29.545	2.733	0.156	***
Socio-Economic Status (ESCS)	45.171	1.692	0.467	***	20.114	1.802	0.208	***
Gymnasium					146.612	7.984	0.732	***
Realschule					78.408	8.419	0.397	***
Gesamtschule					48.433	9.637	0.155	***
Hauptschule <Ref.>								
Grade minus 10								
Mother Part-time								
Mother No Occupation								
Mother Full-time <Ref.>								
Mo Part-time* SES(ESCS)								
Mo No Occ. * SES(ESCS)								
R^2	0.224				0.476			
R^2 Increase					0.252			

*** P<.001 **P<.01 * P<.05 $^{+}$ P<.10 N=3855

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

(continued)

	Model 3				Model 4				Model 5			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	465.681	7.488		***	459.042	7.360		***	460.022	7.375		***
Gender (Male=1, Female=0)	32.012	2.507	0.169	***	32.076	2.484	0.170	***	32.037	2.464	0.169	***
Socio-Economic Status (ESCS)	16.718	1.684	0.173	***	16.750	1.705	0.173	***	13.985	2.339	0.145	***
Gymnasium	129.205	7.546	0.645	***	129.476	7.429	0.647	***	129.392	7.439	0.646	***
Realschule	66.069	7.940	0.335	***	66.432	7.891	0.337	***	66.253	7.929	0.336	***
Gesamtschule	33.461	9.367	0.107	***	34.087	9.398	0.109	***	34.061	9.404	0.109	***
Hauptschule <Ref.>												
Grade minus 10	40.053	2.391	0.274	***	40.036	2.397	0.274	***	40.059	2.393	0.274	***
Mother Part-time					11.439	3.198	0.059	***	10.637	3.270	0.055	***
Mother No Occupation					6.445	3.662	0.030	+	5.495	3.665	0.026	
Mother Full-time <Ref.>												
Mo Part-time*SES(ESCS)									2.615	2.954	0.017	
Mo No Occ.* SES(ESCS)									5.311	3.444	0.032	
R^2	0.543				0.546				0.547			
R^2 Increase	0.067				0.003				0.001			

*** P<.001 **P<.01 * P<.05 + P<.10

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

(Japan)

Table 3. Regression Analysis of Predicting Student's Math Performance

	Model 1				Model 2			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	533.751	3.520		***	466.528	8.140		***
Gender (Male=1, Female=0)	12.893	4.921	0.065	**	12.897	3.876	0.065	***
Socio-Economic Status (ESCS)	44.458	4.190	0.323	***	13.584	2.573	0.099	***
General-A					144.154	9.071	0.665	***
General-B					73.210	9.720	0.301	***
Vocational					33.620	9.587	0.145	***
General-C <Ref.>								
Grade minus 10								
Mother Part-time								
Mother No Occupation								
Mother Full-time <Ref.>								
Mo Part-time* SES(ESCS)								
Mo No Occ.* SES(ESCS)								
R^2	0.107				0.381			
R^2 Increase					0.274			

*** P<.001 **P<.01 * P<.05 + P<.10 N=4339

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

(continued)

	Model 3				Model 4				Model 5			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	466.528	8.14		***	462.594	8.321		***	462.594	8.314		***
Gender (Male=1, Female=0)	12.897	3.876	0.065	***	12.929	3.859	0.065	***	12.908	3.852	0.065	***
Socio-Economic Status (ESCS)	13.584	2.573	0.099	***	14.197	2.626	0.103	***	13.797	3.377	0.1	***
General-A	144.154	9.071	0.665	***	143.688	9.091	0.663	***	143.720	9.085	0.663	***
General-B	73.210	9.720	0.301	***	72.966	9.680	0.300	***	73.030	9.673	0.301	***
Vocational	33.620	9.587	0.145	***	33.412	9.563	0.144	***	33.479	9.549	0.145	***
General-C <Ref.>												
Grade minus 10	--------	--------	--------		--------	--------	--------		--------	--------	--------	
Mother Part-time					7.065	3.819	0.065	+	6.700	3.812	0.033	+
Mother No Occupation					5.108	4.124	0.103		5.055	4.139	0.023	
Mother Full-time <Ref.>												
Mo Part-time* SES(ESCS)									-1.760	4.657	-0.008	
Mo No Occ.* SES(ESCS)									3.419	4.815	0.014	
R^2	0.381				0.382				0.383			
R^2 Increase	0.000				0.001				0.001			

*** P<.001 **P<.01 * P<.05 + P<.10

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

Table. 4 Regression Analysis of Predicting Student's Grade (Deviation from 10) (Germany)

	Model 1				Model 2			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	-0.882	0.018		***	-1.180	0.037		***
Gender (Male=1)	-0.101	0.024	-0.078	***	-0.062	0.023	-0.048	**
SES (ESCS)	0.151	0.009	0.229	***	0.085	0.012	0.128	***
Gymnasium					0.435	0.045	0.318	***
Realschule					0.308	0.039	0.229	***
Gesamtschule					0.374	0.041	0.175	***
Hauptschule <Ref.>								
R^2	0.059				0.108			
R^2 Increase					0.049			

*** P<.001 **P<.01 * P<.05 + P<.10 N=3858

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

To test this relationship, we have regressed student's grade on gender, socio-economic background and school type dummies (Table 4). Socio-economic status has significant effect on student's grade, and it is still significant even after controlling by school type variables. This result indicates that grade as well as school type mediates SES influence on math performance. Such an intermediate function of grade in part contributes to the direct path from socio-economic background to math performance shown in Figure 2. In this sense, the retention system in Germany contributes to inequality of educational opportunity.

4-b. Mother's Job Status

Nowadays many mothers work outside the house. Does a mother's job status have any influence on a child's academic work? Germany and Japan shows a similar distribution. One third of mothers are working full-time. Nearly 40 per cent work part-time, and rest of them are looking for job or have no occupation.

In the analysis, we use part-time dummy and no occupation dummy (including no occupation and looking for job). Full-timer is their reference category. Model 4 in Table 2 shows the result of mother's job status on students' math test scores in Germany. Inclusion of mother's job status dummies added .003 points to R^2. If a student's mother works as a part-timer, their math test score increases by 11 points compared to those who have full-time working mother. If a student's mother has no occupation, such a student gets 6 points more. This result suggests that mother who stays at home for a longer time has a positive influence on child's academic activities in Germany. In addition, the interactions of mother's job status with socio-economic status in model 5 are positive, which are not statistically significant. This implies such mother's influence is more effective in high socio-economic status families.

If a student's mother is part-timer or has no occupation, she has a positive influence on a student's academic performance in Japan (Table 3). But their effects are not as large as those in Germany. An increase of R^2 between Model 3 and Model 4 is only .001. It is true that mother's job status affects her child's math performance in Japan, but it is more important in Germany than in Japan.

4-c. Study Hours Outside Schools

Students study not only in schools but also at home. In some societies, they spend much time of study in other private educational institutions in addition to school. It is worth analyzing study outside school because it has the possibility to mediate between family background and students' academic performance. PISA's 2003 student questionnaire includes questions about study hours per week inside and outside school. Out of these questions, we utilize the answers to three questions on the numbers of study hours outside of school engaged in (1)homework, (2)out-of-school classes and (3)other study. The total hours of these three kinds of extra-curricular study are used for this analysis.

Table 5.Regression Analysis of Predicting Student's Math Performance<Study Outside of School>

	Germany				Japan			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	470.082	7.520		***	463.733	8.967		***
Gender (Male=1)	27.335	3.223	0.156	***	15.124	4.122	0.078	***
SES (ESCS)	14.770	1.783	0.163	***	11.603	2.763	0.085	***
Gymnasium / General-A	124.454	7.548	0.692	***	126.013	9.548	0.604	***
Realschule / General-B	64.071	7.305	0.351	***	67.215	9.880	0.286	***
Gesamtschule /Vocational	37.929	10.499	0.124	***	32.722	10.023	0.145	***
Hauptschule / General-C	<Ref.>							
Grade minus 10	34.359	2.478	0.245	***	--------	--------	--------	
Mother Part-time	13.202	3.168	0.074	***	4.188	4.037	0.021	
Mother No Occupation	8.225	3.886	0.041	*	4.199	4.370	0.019	
Mother Full-time <Ref.>								
Outside School Study (Hours/Week)	-0.602	0.223	-0.040	***	1.765	0.306	0.136	***
R^2	0.500				0.388			
N	N=2840				N=3608			

*** P<.001 **P<.01 * P<.05 + P<.10

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

In Germany, the average number of homework hours per week is 6.27, that of out-of-school classes is 0.13 and that of other study is 1.35. Japanese students spend 3.78, 0.56 and 1.96 hours per week respectively. Total average study hours outside school that students spend in a week are longer in Germany than in Japan.

We add total hours of study outside school to Model 4 of both countries (Table 2 and Table 3). The results are summarized in table 5. This table shows clear difference between two countries. The coefficient of study outside of school is negative in Germany. Conversely, in Japan, it is positive and is much larger than that in Germany. Table 6 and Table 7 show factors that predict the length of

outside school study. The first model includes only family background variables. Three school type dummies are added to the first model.

In Germany, female students study two hours more than male students outside schools. Students from higher socio-economic status family study more. If school type dummies are introduced to the equation, socio-economic status no longer has an effect on outside school study hours. Socio-economic status and mother's job status have stronger effects on study outside school in Japan than those in Germany. One standard deviation of socio-economic status increases students' study 2.6 hours per week, and students who have mother without occupation study 1.4 hours more per week than those whose mothers work full-time. Even after controlling by school type variables, socio-economic status and mother's job status are still statistically significant.

Table 6 and Table 7 show another aspect of the two countries which differ. School type effects on outside school study are much stronger in Japan than in Germany. In Germany, Gymnasium students study longest outside school in four types of schools. After controlling by family background and gender, Gymnasium students study 1.2 hours longer than Hauptschule students do per week. In Japan, a General-A school student studies than one hour more everyday (more 7.4 hours per week) than General-C high school student. Whereas we can find the deference of study hours between school types in three aspects in Japan, we can do that only in homework hours in Germany[9]. Such a difference and an opposite direction of outside school study effects on math performance reflect the different features of outside-school studies in the two countries.

Table 6. Regression Analysis of Predicting Student's Outside School Study Hours(Germany)

	Model 1				Model 2			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	8.538	0.247		***	8.046	0.423		***
Gender (Male=1)	-2.050	0.228	-0.179	***	-1.911	0.234	-0.166	***
SES (ESCS)	0.388	0.124	0.065	**	0.145	0.128	0.024	
Mother Part-time	-0.019	0.261	-0.002		-0.036	0.254	-0.003	
Mother No Occupation	0.081	0.258	0.006		0.070	0.255	0.005	
Mother Full-time <Ref.>								
Gymnasium					1.195	0.469	0.101	*
Realschule					0.268	0.427	0.022	
Gesamtschule					-0.543	0.635	-0.027	
Hauptschule <Ref.>								
R^2	0.037				0.045			

*** P<.001 **P<.01 * P<.05 + P<.10 N=2841

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

9 Gymnasium students study nearly 2 hours longer than Hauptschule students at homework. In Japan, General-A school students study 5 hours longer than General-C school students at homework. In addition, General-A school students study an hour longer in out-of-school classes and spend 2 hours longer in other study than General-C school students.

Table 7. Regression Analysis of Predicting Student's Outside School Study Hours (Japan)

	Model 1				Model 2			
	Coefficient Estimate	Standard Error	Standardized Coefficient		Coefficient Estimate	Standard Error	Standardized Coefficient	
Intercept	6.395	0.425		***	3.851	0.393		***
Gender (Male=1)	-0.848	0.412	-0.057	*	-0.932	0.321	-0.062	**
SES (ESCS)	2.658	0.308	0.253	***	0.887	0.239	0.084	***
Mother Part-time	0.229	0.326	0.015		-0.091	0.256	-0.006	
Mother No Occupation	1.446	0.339	0.086	***	0.889	0.292	0.053	**
Mother Full-time <Ref.>								
General-A					7.448	0.852	0.462	***
General-B					2.313	0.691	0.127	**
Vocational					0.199	0.353	0.011	
General-C <Ref.>								
R^2	0.075				0.230			

*** P<.001 **P<.01 * P<.05 + P<.10 N=3608

(Students who respond to Father's and Mother's Current Situation: Q05 & Q06)

In Japan, study at outside schools improves academic performance. Because the entrance examination plays an important role in admission to high schools and universities in Japan, many students prepare for this exam not only in their schools but also in outside schools. In this context, students' studies outside schools enhance their academic performance, especially in highly ranked schools. On the contrary, in Germany, outside school studies have a negative effect on academic performance. This feature is clearest at Gymnasium. This means outside school study in Germany has remedial or supplementary functions. Low variation of school average test performance of Gymnasium, which is presented in Figure 1a, is in part attributable to such functions of outside school studies as remedying low academic performance.

Let us shift our focus to the relationship between outside school study hours and mother's status. Table 8 shows the partial correlations between mother's status variables and four outside-school study variables controlled by socio-economic status variables and school type. In this table statistically significant coefficients are indicated positive signs and negative signs. In Germany, only mother's education correlates with hours of homework and with hours of other study negatively. But, except for mother's part-time position with out-of-school hours, mother's education and mother's "no occupation status" positively correlated with outside-school study hours in Japan. Mothers without occupation, most of them housewives, have a positive effect on all aspects of outside school study. In other words, mothers staying at home control their children's academic activities outside schools. In addition, highly educated mothers give unstinting financial support to their children via paying for private tutors and for tutoring at cram schools.

Table 8. Outside School Study Hours and Mother's Status (Partial Correlation)

		Homework	Tutor	out-of-school	other study
Germany	Mother's Education (Years of Schooling)	−			−
	Mother Part-time				
	Mother No Occupation				
Japan	Mother's Education (Years of Schooling)		+	+	
	Mother Part-time			−	
	Mother No Occupation	+	+	+	+

P<0.05

(Students who respond to Father's and Mother's Currently Situation: Q05 & Q06)

Parental Occupational Status
Home Possessions
3 School Dummy Variables
} are controlled

These results show how the mother's role differs between two countries. In Germany, the mother directly influences her child's academic performance at home, whereas the Japanese mother influences academic performance through her control over the child's outside school study activities. The mother's role in the family is thus dependent on difference in the educational systems, including shadow educational systems, in the two countries.

5. Summary and Discussion

In this paper, we explored why the strength of family background influence on student's academic achievement is so different in Germany and in Japan. We attempted to clarify the factors which produce the difference in the relationship between family background and student's performance. For this purpose, we drew attention to the institutional intermediates which make this difference. First, we focused on secondary school system of Germany and of Japan. Secondly, we focused on outside school learning and the mother's role as important factors that connect family background with student's performance.

As far as school position is measured by school (or school type) average test scores, schools' intermediate function to connect socio-economic status and academic performance is not so different between two countries. However, the direct path from socio-economic status to math performance is stronger in Germany than in Japan. One possible explanation is that the retention system mediates between socio-economic status and students' performance. In Germany, grade is explained by socio-economic status and math performance is explained by grade even if controlled by gender and school types. This implies that the retention system works as another intermediate device that connects socio-economic status and academic achievement.

In Germany, the mother influences the child's academic achievement directly. German mothers stay at home and teach their children in a face-to-face environment. The positive interaction effect of socio-economic status with mother's job status on math performance shows socio-economic status has additional effect if mother stays at home longer, though they are not statistically significant. This implies that the mother, probably the educated mother, exerts a positive influence on her child. Such an educational practice at home may be reflected in this result. Japanese educated mothers may teach their children at home like German mother. In addition, her important educational practice is effectively controlling or coordinating outside school study, including shadow education. The mother's presence at home has an influence on in-the-home studies. Mother's education and presence

at the home also affect the use of shadow education. Overall, mothers play an important role in improving academic performance of children in both countries. As shown in this analysis, the mother's educational practices depend on the social and educational environments of each society.

In the final section, we discuss the difference between basic educational features in the two countries. We have already pointed out the huge variation between students' test scores in Germany and in Japan, and that the correlation between socio-economic status and students' math performance is much stronger in Germany than in Japan. Why is it that such similarity and dissimilarity appears between these two countries?

For the strong relationship between socio-economic status and students' academic achievement, much research has pointed out that early stage selection has an influence on this relationship. In addition, based on a comparison of the any given country's variation, Hanushek and Wößmann (2006) indicated that early start tracking contributes to widen students' academic achievement gap. In this view point, Germany and European countries with similar educational system are typical cases for this type of explanation. Japan is not suitable for this explanation. Whereas late start tracking dampens the correlation between SES and students' achievement in Japan, it should not widen students' achievement gap. But Japanese students' variation is large enough to be at top ranks in the PISA participant countries, and widening process appears in comparison of TIMSS data[10]. These findings need different explanation from Hanushek and Wößmann's.

How can we explain the Japanese exception? In the earlier section, we discussed the entrance examination and function of out-of-school studies. Japanese universities and Japanese high schools are stratified in descending order of difficulty on entrance examination. In this context, students who have high academic abilities and educational aspirations study more and more. This condition widens a gap of students' test performances. On the other hand, this competition decreases the correlation between socio-economic status and students' test performance, because theoretically students' academic ability and their academic preference become independent from their parents' characteristics as they grow. The Japanese educational environment thus presents a particular set of consequences arising from the educational outcomes of students' academic performance.

10 The TIMSS survey results indicate that not only countries with early tracking systems, but also countries which have university entrance examination systems widen the variation of students' achievements.

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