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Discussion Paper No. 963

**LONG-TERM EFFECT  
OF INTERNATIONAL TRADE  
ON THE GENDER WAGE  
AND EDUCATIONAL GAPS**

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# Long-Term Effect of International Trade on the Gender Wage and Educational Gaps

Eiji Yamamura

*Abstract.* This paper uses cross-country data to examine the long-term effect of trade openness on the gender gaps in wages, education, political empowerment and health. Key findings are: trade openness since 1970 reduced the gender gaps in wages and educational attainment as of 2011 but did not influence the gaps in political attainment and health status. The effect of trade openness on the gender wage gap remained observable in later years (1980, 1990 and 2000), although it decreased in degree over time. On the other hand, the effect of trade openness on the gender gap in educational attainment disappeared in 2000. Similar results were obtained even after controlling for endogenous bias.

Key words: International trade; Globalization; Gender wage gap; Gender educational gap

JEL classification: F16; F66; J16; I14; I24

## 1. Introduction.

In the present era of globalization, markets have become increasingly open. Globalization has increased the number of individuals participating in markets, leading to markets becoming more competitive. Competitive pressure through international trade seems to change not only efficiency but also non-market interpersonal relations.

The gender gap is a hot issue in modern society (World Economic Forum 2011; Wolszczak-Derlacz 2013). For instance, economic researchers have paid considerable attention to analyzing the nature of the gender wage gap (Weichselbaumer and Winter-Ebmer 2005). According to the seminal work of Becker (1959), increased competition in the product market reduces discrimination in the long run. If this finding is correct, increasing competitive pressure through international trade should reduce discrimination against women and decrease the gender wage gap. However, arguments against this hypothesis also exist based on Becker's theory<sup>1</sup>. Existing literatures have attempted to empirically test this hypothesis (Berik, Vand der Meullen Rodgers and Zveglic 2004, BVZ; Black and Brainerd 2004; Menon and Vand der Meullen Rodgers 2009)<sup>2</sup>. Black and Brainerd (2004) used census data from the United States to find that trade reduces the ability of firms to discriminate against women. Conversely, other works

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<sup>1</sup> Various researchers have analyzed the relation between trade liberalization and gender gaps (e.g., Van Staveren et al. 2007; Fontana 2009).

<sup>2</sup> Saure and Zoabi (2014) constructed the model to show that the marginal productivity of women drops more than that of men if trade expands sectors with intensive female employment. Thus, the gender wage gap widens.

using data from Asian countries such as Taiwan and Korea (BVZ 2004) and India (Menon and Vand der Meullen Rodgers 2009) failed to find that competition from trade decreased wage discrimination against women. Because these works use data from certain countries, the estimation results vary according to social and economic conditions in the countries from which data is obtained. Hence, it is necessary to conduct the examination using cross-country data to investigate how Becker's theory generally applied to the gender wage gap.

Discrimination against women in the labor market decreased with increasing international trade. Under this condition, women's marginal productivity is reflected in their wage levels. Human capital, such as educational attainment, is thought to play a more important role for women in the labor market as international trade increases. In response to this, educational attainment for women naturally improved, and consequently the gender gap in educational attainment decreased. Thus far, the impacts of globalization on education spending and human capital formation have been examined (e.g., Anderson and Konard 2003 a; 2003 b; Baskaran and Hessami, 2012; Shastry 2012). However, little is known about how international trade influences the gender gap in educational attainment. It is valuable to explore the effects of international trade on the gender wage and education gaps, and simultaneously to consider the mechanism of how competitive pressure associated with trade changes gender inequality in the labor and education markets. This study analyzes how international trade influences the gender gaps by considering jointly the decrease in discrimination against women and the increase in women's human capital.

If gender gaps do not immediately respond to trade openness, it is useful to consider the

long-term effect of trade openness on gender gaps. To this end, the effect of trade openness in 1970 on the gender gaps in 2011 is examined. Furthermore, this paper compares this effect with those of trade openness in intervening years (1980, 1990 and 2000) to consider the time lag in the appearance of any effect. This paper used a cross-country dataset sourced mainly from the World Bank and the Global Gender Gap Report 2011 (GGGR2011).

The key findings were the following. Trade openness decreased the gender wage gap in 2011 regardless of the number of years of trade openness. However, the strength of this effect decreased as the number of years of trade openness increased. On the other hand, trade openness in 1970 decreased the gender gap in educational attainment, which was robust to alternative specifications. However, the effect on the gender education gap of trade openness in intervening years (1980, 1990, 2000) was less robust.

The remainder of this paper is organized as follows. Section 2 proposed testable hypotheses. Section 3 explained the data and empirical method. Section 4 presented the estimation results and their interpretation. The final section provided conclusions.

## **2. Hypotheses**

If the gender wage gap decreases owing to international trade, female students are predicted to have a greater incentive to learn. Consequently, the cognitive skills of female students will improve relative to those of male students (Guiso, Monte, Sapienza and Zingales 2008; Fryer and Levitt 2010). The higher the scores of female students in achievement tests, the more likely girls are to get scholarships for entrance to higher-level

schools and the greater the incentive of parents to invest in the education of daughters relative to sons. Restated, international trade decreases the gender gap in educational attainment. However, human capital accumulation proceeds slower than improvement of wage levels because it takes over 20 years for a newborn girl to graduate from tertiary education. Therefore, it takes many years for the responses of female students to improved female wage levels to be reflected in female educational attainment. Moreover, parents of daughters have a larger incentive to invest in their daughters' education only after observing a relative increase in female wages. Hence, a time lag exists between the decreases in the gender wage gap and the gender educational attainment gap.

Based on the above observations, I propose the following testable hypotheses:

Hypothesis 1: Trade openness decreased not only the gender wage gap but also the gender education gap,

Hypothesis 2: The effect of trade on the gender education gap trails its effect on the gender wage gap.

### **3. Data and method**

#### *Data 3.1.*

As is presented in Table 1, the cross-country data used in this paper were gathered from various sources. Discrimination against women can exist in various contexts and so the World Economic Forum (2011) considered various subcategories of the gender gap to calculate the Global Gender Gap Index (GGGI). To test the hypotheses proposed in the previous section, it is useful to use data for subcategories of the gender gap, rather than

GGGI. In GGGR for 2011, the World Economic Forum (2011) provided not only the gender wage gap but also the gender gaps in educational, political and health situations in 2011. These data are used for estimations. Furthermore, the World Bank provided data on trade openness in various years. To compare the long-term and medium-term effects of trade, this paper used trade openness in 1970, 1980, 1990 and 2000. Additionally, data on GDP per capita in 1970, 1980, 1990 and 2000 were gathered from the Penn World Table. As for other national characteristics, the degree of democracy, legal origins, religions and latitude used in La Porta, Lopez de Silanes, Shleifer and Vishni (1999; LLSV) were obtained from the website of Shleifer. The total sample size was 92 (92, 100 and 109) when using trade openness in 1970 (1980, 1990 and 2000). Data on trade openness were not available for some countries in the earliest years of opening up, and this is why the sample size was smaller in the earlier years.

According to the definition in Table 1, the wage gap variables such as WAGE\_GAP (EDUC\_GAP, POLI\_GAP and HEAL\_GAP) show the female-male ratios of proxies for the wage, educational, political and health situations. Accordingly, the larger the values of these gender gap variables, the better the situations of women. In Fig. 1 (a)–(d), the vertical axes are WAGE\_GAP, EDUC\_GAP, POLI\_GAP and HEAL\_GAP, respectively. In the figures, the horizontal line is OPEN\_1970 (trade openness in 1970). Cursory examination of Fig. 1 (a) reveals wide variation of WAGE\_GAP, which ranges between 40 % and 90 %. Furthermore, OPEN\_1970 was positively related to WAGE\_GAP. This implies that trade openness decreases the gender wage gap, in line with Becker's theory. Compared with WAGE\_GAP in Fig. 1 (a), EDUC\_GAP and HEAL\_GAP were concentrated in the upper



ranges of the vertical axes in Fig. 1 (b) and (d). In most countries, EDUC\_GAP (HEAL\_GAP) gap exceeded 80 % (95 %), indicating that these gaps were very small. In contrast, POLI\_GAP was concentrated in the lower range of the vertical axis in Fig. 1 (c). In most countries, POLI\_GAP was below 40 %. Therefore, political gap was generally very large. Furthermore, Fig. 1 (b)–(d) did not show that OPEN\_1970 was clearly related to EDUC\_GAP, POLI\_GAP and HEAL\_GAP, respectively. These figures do not control for other variables such as national characteristics. Hence, in section 3, to examine the data more closely, I conducted regression estimations to control for various factors.

*Baseline model 3.2.*

To test the hypotheses, this study attempted to examine the effect of trade openness on gender gaps. To this end, the following estimated function of the baseline model was used:

$$Y_i = \alpha_0 + \alpha_1 OPEN\_1970_i + \alpha_2 Ln(GDP\_1970)_i + X'B + \varepsilon_i$$

*Y:* WAGE\_GAP (EDUC\_GAP, POLI\_GAP or HEAL\_GAP)

*X:* Vector of variables to control for country characteristics

*B:* Vector of coefficients of variables to control for country characteristics

where  $Y_i$  represents the dependent variable (proxy for the gender gap in 2011) for country  $i$ . Regression parameters are represented by  $\alpha$ . The error term is represented by  $\varepsilon_i$ . Furthermore, disturbances in the equation when WAGE\_GAP is a dependent variable may correlate with disturbances when EDUC\_GAP (POLI\_GAP or HEAL\_GAP) is a dependent variable. WAGE\_GAP, EDUC\_GAP, POLI\_GAP and HEAL\_GAP are thought to be jointly

estimated because of correlations between disturbances. In this case, a seemingly unrelated regression model (SUR) model is preferred (Greene 2008).

The key independent variable for investigating the long-term effect of trade openness is OPEN\_1970. In terms of alternative specifications, using trade openness at 10-year intervals (OPEN\_1980, OPEN\_1990 or OPEN\_2000), I attempt to check the robustness of the effects of OPEN\_1970 and its medium-term effects. From Hypothesis 1, the coefficient of OPEN\_1970 (OPEN\_1980, OPEN\_1990 or OPEN\_2000) is predicted to be positive when WAGE\_GAP (or EDUC\_GAP) is the dependent variable. Furthermore, from Hypothesis 2, trade openness is more likely to be statistically significant for estimation of EDUC\_GAP in the earlier years of that trade openness. Additionally, the log of GDP per capita in the comparison year is included to control for degree of economic development.

Political factors are considered critical to the effects of globalization on labor condition and human capital formation (e.g., Anderson and Konard 2003 a; 2003 b; Baskaran and Hessami 2012). Furthermore, globalization outcomes differed among the regions to which the studied countries belong (BVZ 2004; Black and Brainerd 2004; Menon and Vand der Meullen Rodgers 2009; Boler 2015). For instance, the North American Free Trade Agreement (NAFTA) critically impacted the gender gap (Juhn and Ujhelyi 2013; 2014). It is necessary to consider these factors for the sake of generality of the estimation results based on the cross-country data. Regarding the control variables included in  $X$ , political, legal, geographical and religious conditions are taken into account. To reduce the possibility of reverse causality, as described in the definition of Table 1, time varying variables such as DMOCR and religious variables (CATHO, PROT and MUSL) are

included in the far distant year. In more democratic countries, the gender gap seems reduced and so the coefficient of DMOCR is expected to have a positive sign. Legal origin is an important institutional factor that influences economic and political conditions (La Porta, Loez-de-Silanes and Shleifer 2008) and so LEGAL\_FR, LEGAL\_SO, LEGAL\_GE and LEGAL\_SC are included to control for it. Roles played by women are determined by religion and should be taken into account. This is why CATHO, PROT and MUSL are included. Geography and regional specific factors are taken into account by incorporating latitude and dummies for region such as ASIA, S\_AMERIC and EUROP.

### *Model using instrumental variables 3.3.*

Gender wage and educational gaps may influence international trade relations (Busse and Spielmann 2006). Furthermore, gender gaps may influence GDP per capita. For instance, an increase in women's human capital may lead women to become skilled labor, which in turn influences GDP. If such an effect holds, reverse causality leads to endogenous bias in the estimation results. Trade openness and GDP can be considered the predetermined exogenous variable because of long time lags between the dependent and independent variables. However, to more closely examine the effect of openness, exogenous instrumental variables are used to control for bias based on the GMM 2SLS model (Greene, 2008).

In this model, trade openness and log of GDP are treated as endogenous variables. Log of population size in the same year as the trade openness, DMOCR, and legal origin dummies are used as exogenous instrumental variables that are included in the first stage

estimation but not the second stage estimations. Country size is expected to cause scale economy, which in turn influences openness and GDP. However, population size did not seem to influence the gender gap, which suggests the validity of the instrumental variable. As shown later in Table 2, DEMOCR and legal origin dummies did not exhibit statistical significance in most cases of the baseline model. Furthermore, as shown in Table 4 (a)–(d), exclusion of DEMOCR and legal origin dummies did not change the results of trade openness. This indicated that these variables are unlikely to be related to the dependent variables. For robustness check, in alternative specifications of the GMM 2SLS model, DEMOCR is not included in the set of exogenous instrumental variables.

#### **4. Estimation results**

Table 2 presented the results of the baseline (SUR) model where results of all control variables are shown. The results of control variables in Tables 3–6 were no different from those in Table 2, and so only the result of trade openness was shown<sup>3</sup>. Table 3 (a)–(c) showed the results of the SUR model when OPEN\_1970 was replaced by OPEN\_1980, OPEN\_1990 and OPEN\_2000, respectively. Table 4 (a)–(d) reported the results where DEMOCR and legal origin dummies are excluded from the set of independent variables. Table 5 (a)–(d) reported the estimation results of the GMM 2SLS model where the logs of population size in the same years as the trade openness, DEMOCR and legal origin dummies were used as exogenous instrumental variables in the first stage. Table 6 (a)–(d) reported

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<sup>3</sup> Full estimation results of Tables 3 to 6 are available from the author upon request.

the estimation results of the GMM 2SLS model where DMOCR was excluded from the set of exogenous instrumental variables in the first stage.

From Table 2 we can see that OPEN\_1970 was positive and statistically significant at the 1 % level in column (1). Column (2) suggested that the coefficient of OPEN\_1970 was positive and statistically significant at the 5 % level. This implied that trade openness in 1970 reduced the gender wage and educational gaps in 2011. Trade openness thus had the long-term effect of improving female wages and educational level relative to men. This is consistent with Hypothesis 1. Moreover, the absolute value of the coefficient of OPEN\_1970 was 0.06 and 0.02 when the dependent variable was WAGE\_GAP and EDUC\_GAP, respectively. This can be interpreted as implying that a 1 % increase in the trade-GDP ratio (trade/GDP in 1970) leads to increases of 0.06 % and 0.02 % in the gender wage and educational gaps, respectively. Hence, the marginal effect of OPEN\_1970 on WAGE\_GAP was three times larger than that on EDUC\_GAP. In contrast, OPEN\_1970 was negative and not statistically significant in columns (3) and (4). Therefore, trade openness did not have a long-term effect on POLI\_GAP and HEAL\_GAP. It follows from this that competitive pressure in the market was unlikely to influence women's situations in terms of political empowerment and health.

As for other control variables, GDP\_1970 was positive and significant when EDUC\_GAP was the dependent variable, suggesting that the gender educational gap was smaller in more developed countries in 1970. Developed countries could invest in compulsory basic education for both sexes. Consistent with the prediction, the coefficient of DEMOCR was positive in all columns despite not being statistically significant. The

dummies of legal origin showed barely significant results for estimations of WAGE\_GAP and EDUC\_GAP.

Now, switching attention to Table 3 (a)–(c), as for the estimation results of WAGE\_GAP, the coefficient of trade openness was positive and significant at the 1 % level. The absolute value of its coefficient was 0.06 when OPEN\_1980 and OPEN\_1990 were the independent variables, and was 0.05 when OPEN\_2000 was the independent variable. Accordingly, the results of trade openness were persistently similar to those listed in Table 2. With respect to the estimation results of EDUC\_GAP, the variable of trade openness was positive in Table 3 (a)–(c). In Table 3 (a), OPEN\_1980 showed statistical significance whereas OPEN\_1990 and OPEN\_2000 did not suggest significance in Table 3 (b) and (c). These results suggested a long-term effect of trade openness on the gender educational gap, while no medium-term effect of trade openness was observed. This is in line with Hypothesis 2. When it comes to the results of POLI\_GAP and HEAL\_GAP, trade openness did not show statistical significance in Table 3 (a)–(c). Therefore, trade openness did not affect the gender political and health gaps at all. In alternative specifications, the results presented in Table 4 (a)–(d) were almost the same as those presented in Tables 2 and 3 (a)–(c). Hence, the exclusion of DEMOCR and legal origin dummies did not influence the results of trade openness on the gender gaps.

I now turn to the results of GMM 2SLS in Table 5 (a)–(d). First, I used the results of the under-identification and over-identification tests to check the validity of the GMM 2SLS model. A specification error occurs if the instrumental variables are correlated with the error term. In Table 5 (a)–(d), with the exception of column (3), the test statistics of the

over-identification test were not statistically significant and so did not reject the null hypothesis that additional instruments were uncorrelated with the error term. Moreover, in Table 5 (a)–(d), the test statistics of the under-identification test were statistically significant, meaning the null hypothesis that the estimation was under-identified was rejected and hence the under-identification test was passed. The combined results of the under-identification and over-identification tests showed that the GMM 2SLS was valid in Table 5 (a)–(d).

As for WAGE\_GAP, in Table 5 (a)–(d), trade openness was positive and statistically significant at the 1 % level. The absolute values of the coefficient were 0.09, 0.08, 0.08 and 0.07 in OPEN\_1970, OPEN\_1980, OPEN\_1990 and OPEN\_2000. Therefore, the long-term effect of trade openness exceeded its medium-term effect. With respect to EDUC\_GAP, in Table 5 (a)–(d), trade openness was positive and statistically significant.

For robustness check, turning attention to Table 6 (a)–(d), the results of WAGE\_GAP were almost identical to those in Table 5 (a)–(d). However, the statistical significance of EDUC\_GAP varied among the tables although its coefficient was positive in all of them. The coefficients of OPEN\_1970 and OPEN\_1990 were positive and statistically significant, whereas those of OPEN\_1980 and OPEN\_2000 were not statistically significant. Therefore, the effect of openness on the gender educational gap was less robust than its effects on other gender gaps.

Considering the results shown in Tables 2–6 jointly suggested: (1) Trade openness reduced the gender wage gap and its effect was greater in the long term than the medium term. (2) Trade openness in 1970 reduced the gender educational gap although the effects

of the openness in 1980, 1990 and 2000 disappeared in some specifications. Hence, the long-term effect of trade openness was clearly observed but its medium-term effect was less clear.

The effect of trade openness on the wage gap decreased in the later part of the study period. This can be interpreted as implying that the early years of trade openness are more likely to see an increase in women's marginal productivity as a result of decreasing the gender gap in educational attainment. Therefore, the longer-term effect of trade openness on the wage gap increased. That is, the difference in the effect of trade on the wage gap between years of trade openness reflects a decrease in the gender gap in terms of marginal productivity.

Overall, the estimation results can be interpreted as follows: accumulation of women's human capital through education saw women become skilled labor and so improved women's marginal productivity. Restated, decreased educational inequality decreased the gender gap in labor productivity, in turn reducing the gender wage gap. Therefore, the gender wage gap was considered to partly reflect the gender productivity gap. However, besides this indirect effect of trade openness on the wage gap via education, trade openness also directly affected the wage gap by reducing discrimination against women in the labor market.

Based on the findings of this paper, I argue that trade liberalization benefits women by increasing female wages, and I further infer that women should prefer trade liberalization. However, the existing literature provides evidence that women do not prefer trade liberalization (Mayda and Rodrik 2005; Blonigen 2011). An interesting paradox exists



between the findings of this paper and some of the rest of the literature. This raises the question of whether women are irrational concerning free trade. This paradox should be considered by bridging international and behavioral economics.

## **5. Conclusion**

Globalization is expected to increase global competition and improve market function. In this situation, then assuming Becker's theory holds true employment discrimination against women should decrease in the long run. Existing works that have examined this question have not considered the effect of globalization on other gender gaps such as educational attainment, political empowerment and health status. This paper thus attempted to investigate the long-term effect of trade openness on various gender gaps. Long-term effects of trade openness were observed on the wage and education gaps but not on the political and health gaps. Furthermore, the effect of trade openness on the wage gap was two or three times larger than its effect on the education gap. The effect of trade openness on the wage gap was observed regardless of the number of years for which trade openness had existed, although the effect was greater in early years than later years. On the other hand, the effect of trade openness on the gender education gap was not robustly observed for the later years (1980, 1990 and 2000).

Overall, the estimation results can be interpreted as follows: decreased education inequality decreased the gender gap in labor productivity, which in turn decreased the wage gap. Therefore, the gender wage gap was considered to reflect the gender productivity gap.

However, besides this indirect effect of trade openness on the wage gap through education, there also existed a direct effect. Thus, trade openness reduced the gender wage gap caused by gender discrimination. The contribution of this paper is to clarify that market competition through international trade decreased not only the gender wage gap, but also the gap in educational attainment.

Because of data limitations, this paper did not scrutinize the indirect channels through which trade openness reduced the gender wage gap. It is valuable to use individual-level data to decompose the effect of trade openness into the direct effect through decreased discrimination against women in the labor market and the indirect effect through a decrease in the gender marginal productivity gap. Besides, globalization accompanies not only trade openness but also massive population mobility and foreign direct investment. Existing works tried to shed light on the impact of population mobility on human capital investment (e.g., Anderson and Konard 2003 a; 2003 b). The impact of foreign direct investment on the gender wage gap was investigated (e.g., Neumayer and De Soyasa 2007; Oostendorp 2009). It is necessary to analyze the influences of international trade, migration and foreign direct investment jointly. Furthermore, it is interesting to consider how the findings of this paper related to women's preferences regarding trade by bridging international economics and behavioral economics. These issues remain to be addressed in future studies.

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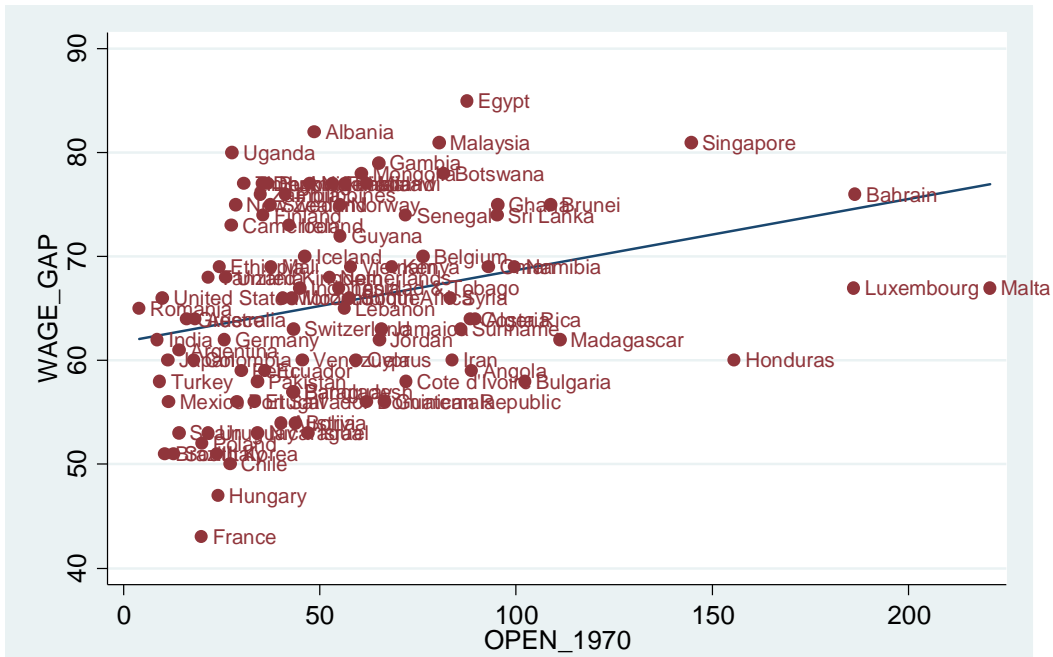


FIGURE 1 (a) Relation between trade openness in 1970 and the gender wage gap in 2011

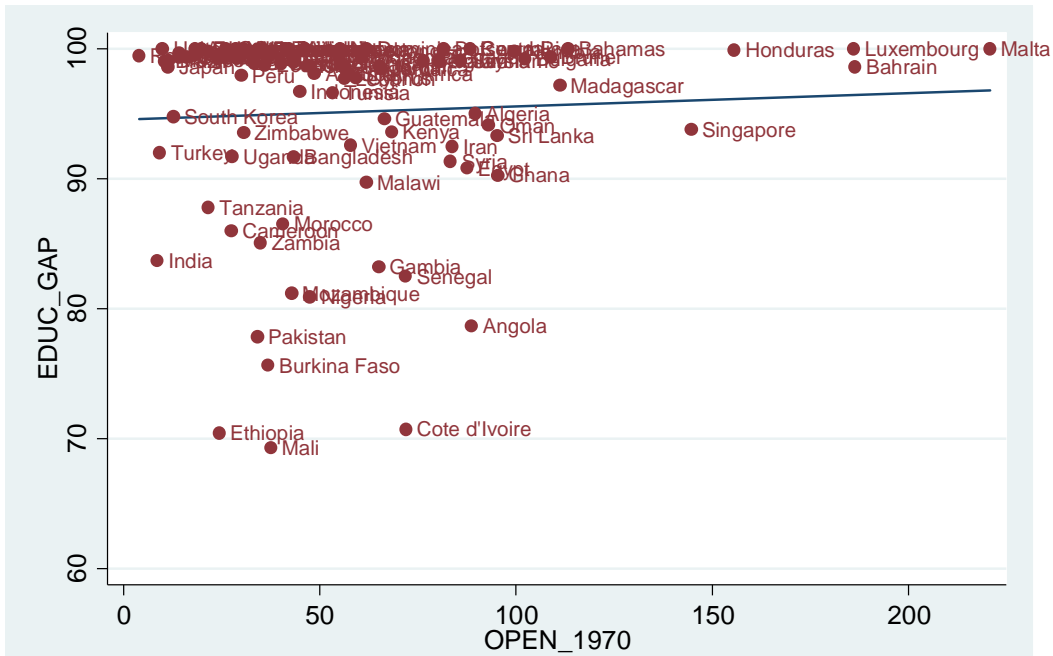


FIGURE 1 (b) Relation between trade openness in 1970 and the gender educational attainment gap in 2011

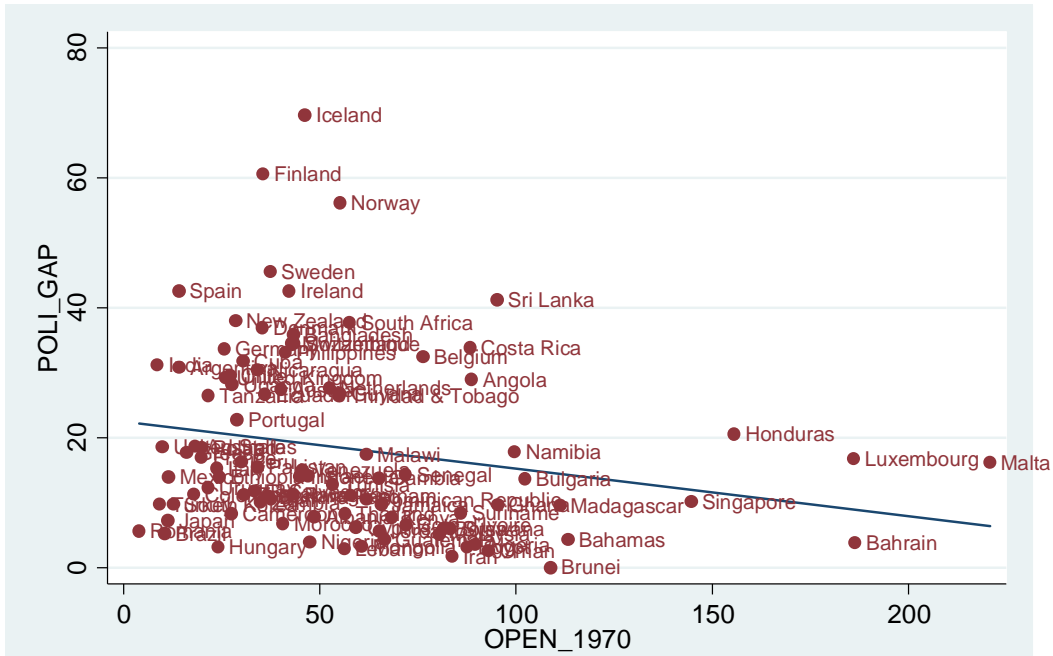


FIGURE 1 (c) Relation between trade openness in 1970 and the gender political empowerment gap in 2011

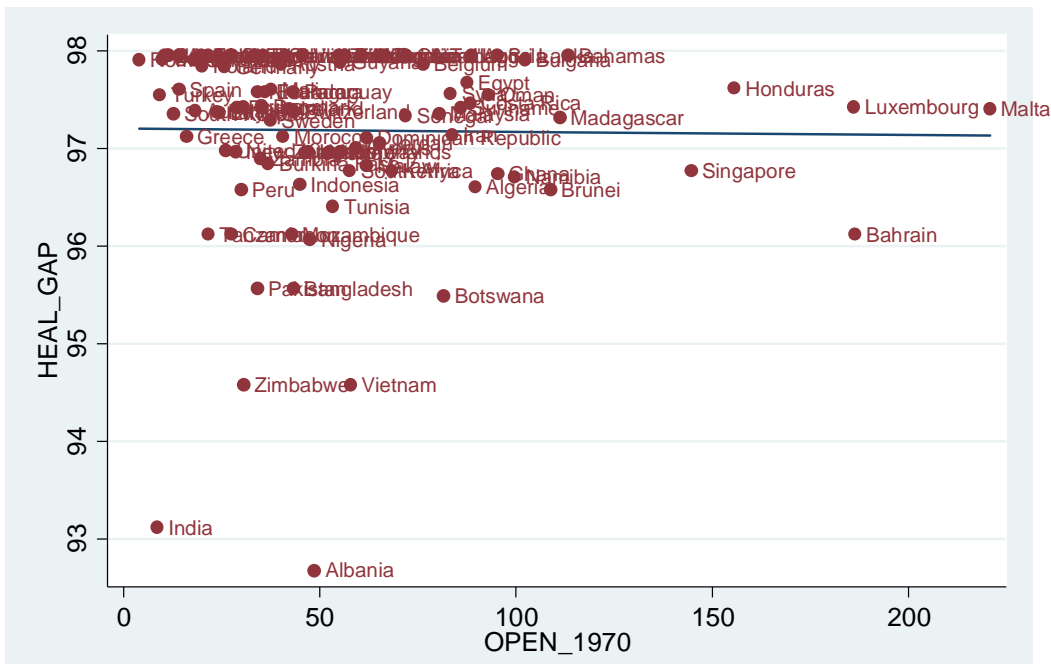


FIGURE 1 (d) Relation between trade openness in 1970 and the gender health and survival gap in 2011



TABLE 1

## Definition and basic statistics of variables

	Definition	Mean value	Standard deviation	Source	
WAGE_GAP <sup>a</sup>	Gender wage gap in 2011 (female wage level / male wage level) * 100	65.3	8.77	GGGR 2011	
EDUC_GAP <sup>a</sup>	Gender education gap in 2011 (female educational attainment / male educational attainment) * 100	95.5	7.48	GGGR 2011	
POLI_GAP <sup>a</sup>	Gender political empowerment gap in 2011 (female empowerment level / male empowerment level) * 100	17.0	13.2	GGGR 2011	
HEAL_GAP <sup>a</sup>	Gender health and survival gap in 2011 (female health and survival level / male health and survival level) * 100	97.1	1.01	GGGR 2011	
OPEN_1970 <sup>b</sup>	Trade openness in 1970 Trade in 1970 / GDP in 1970 (%)	55.0	39.0	World Indicators	Bank
OPEN_1980 <sup>b</sup>	Trade openness in 1980 Trade in 1980 / GDP in 1980 (%)	60.9	40.6	World Indicators	Bank
OPEN_1990 <sup>b</sup>	Trade openness in 1990 Trade in 1990 / GDP in 1990 (%)	61.6	43.7	World Indicators	Bank
OPEN_2000 <sup>b</sup>	Trade openness in 2000 Trade in 2000 / GDP in 2000 (%)	80.1	49.0	World Indicators	Bank
GDP_1970	GDP per capita in 1970 (US \$)	6,574	7,831	Penn and World Table 7.1	
GDP_1980	GDP per capita in 1980 (US \$)	8,731	11,087	Penn and World Table	

				7.1
GDP_1990	GDP per capita in 1990 (US \$)	10,233	10,974	Penn and World Table
				7.1
GDP_2000	GDP per capita in 2000 (US \$)	12,055	13,599	Penn and World Table
				7.1
DEMOCR <sup>c</sup>	Average degree of democracy within a country between 1970 and 1994. Degree of democracy: 1 (Undemocratic) to 10 (Democratic)	4.11	3.98	Website of Andrei Shleifer
LEGAL_FR <sup>d</sup>	French Legal Origin dummy	0.44	0.49	Website of Andrei Shleifer
LEGAL_SO <sup>d</sup>	Socialist Legal Origin dummy	0.18	0.39	Website of Andrei Shleifer
LEGAL_GE <sup>d</sup>	German Legal Origin dummy	0.03	0.18	Website of Andrei Shleifer
LEGAL_SC <sup>d</sup>	Scandinavian Legal Origin dummy	0.03	0.18	Website of Andrei Shleifer
S_AMERICA	South America countries dummy	0.21	0.41	
ASIA	Asian countries dummy	0.13	0.34	
EUROPE	European countries dummy	0.21	0.41	
CATHO	Catholic ratio in 1980 (%)	31.2	36.3	

PROT	Protestant ratio in 1980 (%)	11.9	21.2	Website of Andrei Shleifer
MUSL	Muslim ratio in 1980 (%)	23.7	36.1	Website of Andrei Shleifer
LATITUD	Latitude of capital	0.30	0.19	Website of Andrei Shleifer

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NOTES:

- a. In The Global Gender Gap Report 2011 (GGGR 2011), (female/male) ratio was reported. This paper uses the original ratio multiplied by 100 for convenience of interpretation.
- b. Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
- c. Website of Shleifer <http://scholar.harvard.edu/shleifer/publications/quality-government> (accessed on July 2, 2015). Data were sourced from an earlier work (LLSV 1999).

TABLE 2

Determinants of gender gaps: Baseline model (SUR model)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1970	0.06*** (3.04)	0.02** (2.07)	-0.01 (-0.62)	-0.0001 (-0.07)
Ln(GDP_1970)	-1.77 (-1.53)	1.65** (2.10)	-4.19*** (-2.82)	0.36** (2.50)
DEMOCR	0.13 (0.45)	0.15 (0.75)	0.15 (0.38)	-0.004 (-0.01)
LEGAL_FR	-4.17* (-1.90)	-2.23 (-1.50)	-6.37** (-2.30)	0.46* (1.68)
LEGAL_SO	-4.56 (-1.12)	2.15 (0.78)	-18.6*** (-3.56)	0.30 (0.60)
LEGAL_GE	-3.11 (-0.78)	-3.07 (-1.14)	-3.07 (-0.60)	0.66 (1.34)
LEGAL_SC	6.54 (1.07)	-4.17 (-1.00)	18.4** (2.35)	0.81 (1.07)
S_AFRICA	1.72 (0.64)	-7.68*** (-4.23)	-2.87 (-0.84)	0.06 (0.19)
ASIA	-9.13 (-0.35)	-0.86 (-0.49)	5.14 (1.56)	-0.17 (-0.53)
EUROPE	2.13 (0.72)	-2.80 (-1.39)	5.31 (1.39)	-0.41 (-1.11)
CATHO	-0.07** (-2.32)	0.03* (1.74)	0.13*** (3.25)	0.003 (0.91)
PROT	0.01 (0.24)	0.04 (0.96)	0.13 (1.48)	-0.003 (-0.44)
MUSL	0.01 (0.20)	-0.04* (-1.98)	-0.03 (-0.87)	-0.001 (-0.36)
LATITUD	-6.69 (-0.82)	5.10 (0.93)	21.4** (2.07)	-0.56 (-0.56)
R-Square	0.47	0.63	0.62	0.26
Observations	92	92	92	92

NOTES: Numbers in parentheses are z-values. \*\*\*, \*\* and \* indicate statistical significance at the 1 %, 5 % and 10 % levels, respectively. Constant is included, although its results were not reported.

TABLE 3

Determinants of gender gaps using openness in different years (SUR model)

(a)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1980	0.06***	0.02*	-0.02	0.0002
	(3.44)	(1.65)	(-1.03)	(0.09)
R-Square	0.48	0.64	0.63	0.28
Observations	92	92	92	92

(b)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1990	0.06***	0.01	-0.007	0.001
	(3.69)	(1.47)	(-0.32)	(0.36)
R-Square	0.48	0.61	0.64	0.25
Observations	100	100	100	100

(c)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_2000	0.05***	0.006	-0.001	0.001
	(3.88)	(0.63)	(-0.87)	(0.58)
R-Square	0.47	0.62	0.62	0.23
Observations	109	109	109	109

NOTES: Logs of GDP in 1980, 1990 and 2000 were included in (a), (b) and (c), respectively. Besides the log of GDP, the set of variables included in the equation is equivalent to those used in Table 3 although estimation results were not reported.

Numbers in parentheses are z-values. \*\*\* and \* suggest statistical significance at the 1 % and 10 % levels, respectively.

TABLE 4

Determinants of gender gaps excluding the proxy for democracy and legal origin dummies (SUR model)

(a)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1970	0.06*** (3.15)	0.02** (2.22)	-0.03 (-1.27)	-0.00004 (-0.19)
R-Square	0.42	0.60	0.50	0.21
Observations	95	95	95	95

(b)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1980	0.06*** (3.30)	0.02* (1.67)	-0.04 (-1.62)	0.00002 (0.11)
R-Square	0.43	0.61	0.51	0.21
Observations	95	95	95	95

(c)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1990	0.06*** (3.97)	0.02* (1.68)	-0.01 (-0.72)	0.0001 (0.32)
R-Square	0.44	0.59	0.48	0.20
Observations	100	100	100	100

(d)

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_2000	0.05*** (3.81)	0.01 (1.26)	-0.03* (-1.67)	0.0001 (0.30)
R-Square	0.42	0.59	0.49	0.19

Observations	109	109	109	109
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NOTES: Besides DEMOCR and legal origin dummies, Table 4 (a)–(d) included the control variables, which were equivalent to those in Tables 3 and 4 (a)–(c), respectively. However, estimation results of control variables were not reported.

Numbers in parentheses are z-values. \*\*\*, \*\* and \* suggest statistical significance at the 1 %, 5 % and 10 % levels, respectively.

TABLE 5

Determinants of gender gaps (GMM 2SLS model)

(a) OPEN\_1970 and the log of GDP\_1970 are endogenous variables. Legal origin dummies, DEMOCR and population in 1970 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1970	0.09*** (3.08)	0.04** (2.01)	-0.02 (-0.44)	0.0001 (0.16)
Under-identification test	21.0 p-value=0.00	20.1 p-value=0.00	20.1 p-value=0.00	20.1 p-value=0.00
Over-identification test (Hansen J stat)	4.54 p-value=0.32	5.97 p-value=0.20	12.1 p-value=0.01	5.84 p-value=0.21
Centered R-Square	0.42	0.57	0.45	0.17
Observations	93	93	93	93

(b) OPEN\_1980 and the log of GDP\_1980 are endogenous variables. Legal origin dummies, DEMOCR and population in 1980 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1980	0.08*** (2.98)	0.04* (1.78)	-0.02 (-0.55)	0.0003 (0.69)
Under-identification test	16.2 p-value=0.00	15.4 p-value=0.00	15.4 p-value=0.00	15.4 p-value=0.00
Over-identification test (Hansen J stat)	5.49 p-value=0.24	6.34 p-value=0.17	12.0 p-value=0.00	5.42 p-value=0.24
Centered R-Square	0.43	0.57	0.45	0.17
Observations	93	93	93	93



(c) OPEN\_1990 and the log of GDP\_1990 are endogenous variables. Legal origin dummies, DEMOCR and population in 1990 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1990	0.08***	0.04**	-0.02	-0.0001
	(3.12)	(2.23)	(-0.40)	(-0.35)
Under-identification test	17.0	15.0	15.0	15.0
	p-value=0.00	p-value=0.01	p-value=0.01	p-value=0.01
Over-identification test	6.00	4.42	13.6	4.69
(Hansen J stat)	p-value=0.19	p-value=0.35	p-value=0.00	p-value=0.32
Centered R-Square	0.40	0.55	0.38	0.20
Observations	101	101	101	101

(d) OPEN\_2000 and the log of GDP\_2000 are endogenous variables. Legal origin dummies, DEMOCR and population in 2000 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_2000	0.07***	0.03*	-0.03	-0.0001
	(2.92)	(1.66)	(-0.84)	(-0.30)
Under-identification test	18.9	16.4	16.4	16.4
	p-value=0.00	p-value=0.00	p-value=0.00	p-value=0.00
Over-identification test	6.31	4.18	12.2	4.36
(Hansen J stat)	p-value=0.17	p-value=0.38	p-value=0.01	p-value=0.35
Centered R-Square	0.42	0.55	0.38	0.19
Observations	110	110	110	110

NOTES: The log of population size in the same year of the openness, DEMOCR and legal origin dummies were used as exogenous instrumental variables in the first stage but not the second stage. Besides these, a set of control variables were equivalent to those in Table 4 (a)–(d), respectively. However, estimation results of control variables were not reported.

Numbers in parentheses are z-values. \*\*\*, \*\* and \* suggest the statistical significance at the 1 %, 5 % and 10 % levels, respectively.

TABLE 6

Determinants of gender gaps (GMM 2SLS model)

(a) OPEN\_1970 and the log of GDP\_1970 are endogenous variables. Legal origin dummies and population in 1970 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1970	0.11*** (3.40)	0.04* (1.83)	0.01 (0.15)	0.0001 (0.18)
Under-identification test	10.3 p-value=0.03	9.46 p-value=0.05	9.46 p-value=0.05	9.46 p-value=0.05
Over-identification test (Hansen J stat)	3.17 p-value=0.36	5.96 p-value=0.11	10.3 p-value=0.01	5.43 p-value=0.14
Centered R-Square	0.40	0.57	0.47	0.14
Observations	93	93	93	93

(b) OPEN\_1980 and the log of GDP\_1980 are endogenous variables. Legal origin dummies and population in 1980 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1980	0.10*** (3.24)	0.04 (1.58)	-0.01 (-0.12)	0.0003 (0.70)
Under-identification test	8.58 p-value=0.07	8.00 p-value=0.01	8.00 p-value=0.01	8.00 p-value=0.01
Over-identification test (Hansen J stat)	4.75 p-value=0.18	6.18 p-value=0.10	10.1 p-value=0.01	5.13 p-value=0.16
Centered R-Square	0.40	0.58	0.48	0.14
Observations	93	93	93	93

(c) OPEN\_1990 and the log of GDP\_1990 are endogenous variables. Legal origin dummies and population in 1990 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_1990	0.08*** (3.24)	0.04** (2.20)	-0.01 (-0.30)	-0.001 (-0.41)
Under-identification test	7.67 p-value=0.10	5.62 p-value=0.22	5.62 p-value=0.22	5.62 p-value=0.22
Over-identification test	5.58 p-value=0.13	4.25 p-value=0.23	13.5 p-value=0.00	5.06 p-value=0.16
Centered R-Square	0.42	0.55	0.42	0.21
Observations	101	101	101	101

(d) OPEN\_2000 and the log of GDP\_2000 are endogenous variables. Legal origin dummies and population in 2000 are exogenous instrumental variables.

	(1)	(2)	(3)	(4)
	WAGE_GAP	EDUC_GAP	POLI_GAP	HEAL_GAP
OPEN_2000	0.07*** (2.86)	0.03 (1.53)	-0.04 (-0.92)	-0.002 (-0.56)
Under-identification test	15.0 p-value=0.00	11.9 p-value=0.01	11.9 p-value=0.01	11.9 p-value=0.01
Over-identification test	6.21 p-value=0.10	3.91 p-value=0.27	12.3 p-value=0.00	4.61 p-value=0.20
Centered R-Square	0.42	0.55	0.38	0.19
Observations	110	110	110	110

NOTES: Besides DEMOCR, exogenous instrumental variables were the same as in Table 5. Besides these, the set of control variables were equivalent to those in Table 4 (a)–(d), respectively. However, estimation results of control variables were not reported.

Numbers in parentheses are z-values. \*\*\*, \*\* and \* suggest the statistical significance at the 1 %, 5 % and 10 % levels, respectively.