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GENDER EQUALITY AND DEVELOPMENT

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Gender Inequality and Economic Growth[*]

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Gender inequality is a pervasive feature in many developing countries. The gaps between male and female outcomes and opportunities are present in several dimensions: education, earnings, occupation, access to formal employment, access to managerial positions, access to productive inputs, political representation, or bargaining power inside the household.

These gaps are particularly dramatic in developing countries. Dollar and Gatti (1999) estimate the following education gap in schooling: in the poorest quartile of countries in 1990, only 5% of adult women had any secondary education, one-half of the level for men. In the richest quartile, on the other hand, 51% of adult women had at least some secondary education, 88% of the level for men. On the other hand, the gaps in employment and pay are closing much faster in developing countries than they did in industrialized ones (Tzannatos, 1999), but the prevalence of gender inequality is still sizable, especially in South Asia and the Middle East and North Africa (Klasen and Lamanna, 2009). Moreover, the majority of family workers are women and, often unpaid. Women are also underrepresented among top positions in most countries: even in the most developed ones, the average incidence of females among managers is less than 30% (World Bank 2001).[1] The data also shows that women are typically employed in a reduced number of industrial sectors: more than two-thirds of the global labor force in garment production is females and 1/5th of the total female labor force is in manufacturing.

While these inequalities are undesirable in terms of social justice, one could also argue that a better use of women's potential in the market may result in greater efficiency. However, the microeconomic literature on the efficiency effects of gender inequality is much more extensive than the macroeconomic one.[2] In this paper we study the relationship between gender inequality and economic growth at the macroeconomic level, emphasizing the efficiency losses generated by these inequalities. As argued in Dollar and Gatti (1999) if one interprets gender inequality as evidence of either prejudice or market failure, the gap between

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[1] According to Treiman and Hartman (1981), in the US, 35% of the gap is driven by this margin.

[2] See, for instance Beaman, Chattopadhyay, Duflo, Pande, and Topalova (2009) on women's political participation and Goldstein and Udry (2008) on land use.

males and females is effectively a distortionary tax that has a negative impact on economic growth. Under this interpretation, it is justified to estimate the negative consequences of gender inequality on aggregate productivity.

The paper is organized as follows. In Section 1 we review the theoretical links between the gender gap and economic growth. We first explore the effect of economic growth on gender inequality, and then we document different models in which the causality goes in the opposite direction. The same division is used in Section 2, where we review the empirical evidence on the relationship between these two variables. Section 3 discusses several caveats and drawbacks of the existing theories and empirical studies. Finally, in Section 4 we show a simple theoretical model of talent allocation and gender discrimination and its calibration, and we describe the estimated effects of gender discrimination for different countries.

1.   Review of the Theoretical Literature

1.1. Effects of economic growth on gender inequality

Many authors have argued that gender inequalities are likely to decline with industrialization or economic growth. As Forsythe, Korzeniewicz, and Durrant (2000) explain, studies following this approach consider that differences between men and women in employment, wages or poverty are due primarily to human capital differentials, which are the consequence of traditional structures likely to wither away over time. Part of the existing gender gaps in wages or employment might actually be attributed to discrimination but, since discrimination entails additional costs for agents engaging in such practices, the process of economic growth and market competition is likely to undermine it.

On the other hand, authors following the *Women in Development* (WID) approach, like Boserup (1970), have argued that the initial stages of economic growth are characterized by a growing gender gap, which only begins to diminish once countries develop beyond a certain threshold. The explanation given is that productivity differentials are negligible prior to urbanization and they start growing with the emergence and development of an urban economy. Eventually, discriminatory practices diminish and women get greater access to education and training as well as greater bargaining power inside the household. Economic growth, these authors argue, will only promote gender equality after policy makers intervene to correct the gender biases that accompany the initial stages of development by promoting greater education among women, eliminating distortions in labor markets, and altering property laws.

Finally, the literature from the *Gender and Development* (GAD) approach have emphasized the continuing or rising vulnerability of women over the course of economic development. According to this view, inequalities between men and women are shaped by institutional arrangements such as patriarchal family structures or discriminatory labor practices and property laws, which may not be affected by the economic growth process or could even be affected negatively. Improvements in selected measures of women's status, some claim, cannot be assumed to translate into reductions in inequalities between men and women. Duflo (2010), for instance, concludes that "economic development alone is insufficient to ensure significant progress in important dimensions of women's empowerment

(particularly, decision-making ability in the face of persistent stereotype)" and that "to bring about equality between men and women it will be necessary to take policy action that favor women at the expense of men, and it will be necessary to do that for a long time". Similarly, the World Bank (2001) report concludes that growth alone does not deliver the desired results with respect to gender equality, and that it may be necessary not only to reform legal and economic institutions but also to take active measures to correct the gender gaps in access and control of resources or political voice.[3]

The main theoretical channels proposed in the literature to explain the positive effect of economic growth on gender equality are the increase in women's opportunity cost of not working, which could be consequence of the complementarity between capital and female labor or the increase in the returns to education, the property rights on female human capital returns, the technological progress in household durables, the increase in welfare disparities between sons and daughters, or the increase of the importance of providing good education to mothers to give their children the opportunity to acquire high levels of human capital.

A. The income elasticity channel

Becker and Lewis (1973) argue that the income elasticity of the number of children chosen by families is greater than the income elasticity of the education level received by each of these children. Therefore, there exists an income threshold above which fertility in a given country declines along with a rise in the investment in each child. According to this analysis the rise in income is the main trigger of the demographic transition. An additional implication of this logic is that lower fertility in turn facilitates the incorporation of women to the labor force, hence reducing the gender gap in labor force participation.

B. The women´s opportunity cost channel

In another article, Becker (1981) argues that the rise in income induces a fertility decline because the positive income effect on fertility that is generated by the increase in wages is dominated by the negative substitution effect generated by the rising opportunity cost of children. Under this interpretation, the rise in income eventually reduces the gender gap in pay by increasing women's wages faster than men's.

Galor and Weil (1996) is another important paper linking gender gap and economic growth. They present a theoretical model in which economic growth generates a positive feedback loop by reducing fertility, which leads to a demographic transition and faster output growth. In their model, the increase in capital intensity that accompanies economic growth raises the relative wage of women since, as economies develop, they are more prone to reward the attributes in which women have comparative advantage. In particular, in their model, there

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[3] This is reminiscent of the debate on the so-called "modernization hypothesis" by which economic development would eventually lead to democracy in a given country (Lipset, 1959). Some other authors (see for instance, Acemoglu, Johnson, Robinson, and Yared 2007) argue that it is rather the improvement in institutions that triggers economic development.

are two kinds of labor inputs, physical strength and mental input. Men have more physical strength than women but they have an equal endowment of mental input. Mental input is assumed to be more complimentary to physical capital than labor input and, as result, increases in the amount of physical capital raise the return to mental labor thus increasing the women's relative wage.

This increase in women's relative wage lowers the fertility rate because it induces women to substitute out of childrearing and into market labor. In the model, children are considered durable goods, so that a pure income increase raises the demand for children; however, under the crucial assumption that the substitution effect caused by the increase in children's cost is larger than this income effect, the total effect on children's demand is negative. More specifically, couples receive utility from the number of children they have and from consumption. Time spent raising children cannot be spent working, so the opportunity cost of children is proportional to the wage rate of women. As a result, if the relative wage of mental labor is sufficiently low, women raise children full time and as this wage increases, they join the labor force, increase the fraction of time devoted to market labor, and have fewer children. Finally, higher wage earnings and lower population growth leads to higher levels of capital per worker, and hence faster output growth.

The model exhibits multiple stable stead-state equlibria, one in which fertility is high, output and capital per worker are low, and women's relative wage is low, and another one in which fertility is low, output and capital per worker high, and women's relative wages are also high.[4] As a result, the initial conditions of a country may determine its long run equilibrium, and countries with low initial levels of capital per worker may end up converging to a development trap equilibrium.

Cavalcanti and Tavares (2007) also use the model of Galor and Weil (1996) to argue that economic growth increases women's cost of staying home and leads to higher female labor force participation and higher government spending. In their view, an increase in female labor force participation raises the demand of public services which reduces the cost of child rearing and child care.

C. The property rights channel

Geddes and Lueck (2002) explain the expansion of women's rights associated with economic growth using a property-rights analysis. According to them, if men and women have equal rights, marriage is a share contract and both are able to contract fully inside and outside the marriage. If women have no rights, on the other hand, the marriage becomes a principal-agent system in which the man legally owns the wife and her flow of value. In their model, because property rights are not perfect and there are transaction costs within the family, it is difficult for men to generate the incentives for efficient investment and use of women's human capital. As a result, in this context, since economic growth leads to greater gains from human-capital investment, men are eventually interested in granting women equal rights.

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[4] See Becker, Murphy and Tamura (1990) for a related model.

D. The technology growth channel

Greenwood, Seshadri, and Yorukoglu (2005) propose another channel through which economic growth may affect gender equality positively. In their view, technological progress led to the introduction of labor-saving consumer durables, such as washing machines, vacuum cleaners or refrigerators, which made possible for women to start working in the market and not only at home. In their model, households derive positive utility from the consumption of non-market goods, which are produced using household capital and household labor. Capital goods-specific technological change reduces the relative price of household durables, which enhances their adoption. The adoption of modern appliances in turn frees up the amount of time devoted to housework and makes possible women's liberation from the home as well as the increase of their labor force participation.

E. The children's education channel

Doepke and Tertilt (2009) present another mechanism through which economic growth reduces gender inequality. This channel highlights the fact that men face a trade-off when choosing women's legal rights. In their theoretical model, men want to grant few rights to their wives because this would increase their bargaining power in the household, which has a negative impact on their utility since they value their own consumption more than their wives' and because they care less about the well-being of their children than that of their wives. However, they want an expansion of other women's rights because they are altruistic toward their own children, so they want their daughters to have legal rights - this gives daughters higher welfare - and their sons to be able to find wives with legal rights and higher human capital - because this affects positively the education of their grandchildren.

In the model, when the returns to education are low, men vote for the patriarchy political regime, in which all family decisions are made solely by the husband. Technological progress changes the importance of human capital and leads to a shift in the tradeoff between the rights of a man's own wife and those of their daughters, and once returns to education reach a critical threshold, men vote for the empowerment political regime, under which decisions are made jointly by husband and wife. This theory, the authors conclude, would explain why legal and economic rights of married women improved before women's political rights.

F. The son-daughter welfare disparities channel

Fernandez (2009) proposes a theory similar to the one presented in Doepke and Tertilt (2009) to explain the fact the expansion of women's economic and political rights has coincided with economic development. According to her analysis, capital accumulation and declining fertility altered male interests regarding women's property rights, making men eventually choose a system granting rights to their daughters even if this hurt them as husbands. Under the

patriarchal system, fathers bequest sons more than daughters because the surplus from marriages is captured primarily by their son-in-law. As a result, higher wealth and lower fertility increase the welfare costs of the patriarchal regime over the equal relative to a system of equal property rights, since it increases the disparity of welfare enjoyed by sons versus daughters. When some critical level is reached, fathers are better off sacrificing the consumption benefits they obtain from the patriarchal system in order to ensure that their sons-in-law are more generous with their daughters.

1.2. Effects of gender inequality on economic growth

The costs of gender disparities are high, the World Bank (2001) report states, since they not only reduce the well-being of women, but also reduce that of men and children and hinder economic development. As the report explains, mothers' lack of schooling leads to lower female human capital and poor quality of care for children, as well as an acceleration of the HIV spread. At the same time, according to the report, gender discrimination in the labor market and access to resources leads to inefficiencies in the allocation of inputs and output losses.

This view is also shared by Blackden et al. (2006). In their model gender inequality affects economic growth because it has a negative impact on asset accumulation and factor productivity. More specifically, gender inequality in education is thought to reduce the average amount of human capital in a society, which harms economic performance because of the exclusion of highly qualified girls and the artificial restriction of the pool of talent from which to draw for education. This typically leads to a situation where the marginal return to educating girls is higher than that of boys, indicating an inefficient allocation of schooling. Another cost of limiting female education is that it reduces the human capital of the next generation because women´s education reduces child mortality and fertility significantly.

Some other authors, like Sen (1990) or Klasen and Wink (2002), add that gaps in gender employment and earnings also decrease the bargaining power of women at home, which may lead to lower investments in children's education and health. At the same time, gaps related to access to productive inputs constitute a distortion in the allocation of resources, which in turn reduces aggregate current productivity as well as investment in new technologies.

Finally, it has also been suggested that women are less prone to corruption and nepotism than men as the World Bank (2001) report explains. According to this view, increasing access of women to the workforce and to decision making bodies may improve governance in business and government.

Slotsky (2006) adds that gender differences in behavior may influence aggregate consumption, savings, and therefore macroeconomic performance. According to her analysis, giving more decision power to women affects aggregate productivity because women seem to have a stronger preference for goods and services that contribute to the human capital of children (like education, nutrition, and health) as well as a stronger preference for savings, a lower degree of risk aversion, and a higher propensity to invest in productive projects.

A. The fertility channel

Galor and Weil (1996) is one of the most important theoretical articles linking gender inequality and economic growth through the fertility channel, as explained in section 1.1. According to their analysis, a reduction in gender inequalities raises women's relative wage and increases the cost of raising children, which affects fertility negatively. This leads to lower population growth and higher levels of capital per worker. Similarly, in the model presented in Doepke and Tertilt (2009), an increase in women's rights leads to a decrease in fertility and an increase in the children's education level.

B. The female human capital channel

Lagerlof (2003) argues that gender equality on female education has a positive impact on economic growth because of its effects on fertility and on the human capital of children. In particular, he proposes a model in which families play a coordination game against each other when deciding the human capital level of their offspring. Despite sexes being completely symmetric, gender discrimination arises as a Nash equilibrium because if everybody expects families to behave in a discriminatory manner and educate sons more than daughters, it is optimal for a family to do the same, since daughters will marry more educated men who will earn a higher income. As economies re-coordinate towards a more "gender-equal" equilibrium, women's human capital increases and their time becomes more expensive, which then leads families to substitute quantity for quality in children.

C. The talent reduction channel

Esteve-Volart (2009) presents another channel through which gender discrimination hinders economic development, namely the reduction of available talent in the economy and the distortion on the allocation of talent across occupations. Her article develops an ambitious theoretical model to explore the economic implications of gender discrimination in the labor market in a context where agents are born with random endowments of entrepreneurial talent. After they are born, they decide how much human capital to acquire and whether to become managers or workers. According to her analysis, if women are excluded from managerial positions, equilibrium wages and human capital investment for both male and female workers are reduced and the average talent of managers is lower. Lower talent then leads to less innovation and technology adoption. On the other hand, if women are completely excluded from the labor force, they can only engage in home production, which leads to lower aggregate productivity and lower GDP per capita.

In the model, education is not necessary to work in the home production sector because productivity there is independent of talent, while those that become workers acquire primary education, and if an agent wants to work as a manager she needs to acquire both primary and higher education. Each firm in the market is run by one manager who employs several

workers, and the productivity of the firm depends on both the manager and workers' skills. Technology growth is determined by managers' innovation (the quality of ideas, which also depends on the managers' talent), the rate at which workers adopt new innovations (which in turn depends on their productivity), and by the average education level of the population.

Men and women are assumed to be equally talented at birth, so if women are not allowed to access managerial positions (or they are discriminated in higher education) the average talent of entrepreneurs is lower. This results in less innovation and less demand for worker's skills, leading to a lower equilibrium wage, a lower average education of workers, and a lower technology adoption rate than in a situation without gender discrimination. As a result of all this, this type of discrimination results in an unambiguously lower rate of economic growth.

If on the other hand women are not allowed to become managers or workers, they acquire no education but the market equilibrium wage rate is the same than under no discrimination, since both the demand and the supply of workers' skills is lower. The level and growth rate of output per capita, however, are clearly reduced, provided that technology growth depends on the average education level of the entire population.

D. The migration channel

Baudassé and Bazillier (2011) present a model in which gender discrimination may generate a gender bias in the selection of migrants. One implication of their theory is that a reduction in gender inequality leads to an increase in the average skill of migrating women. Following the argument discussed above by Blackden et al. (2006) and the mechanism of the models by Esteve-Volart (2009) and Cuberes and Teignier-Baqué (2011)[5], a restriction on the pool of available talent in an economy can have important aggregate effects. In particular, in the framework of Baudassé and Bazillier (2011), increases in gender inequality may – under some circumstances - reduce aggregate productivity in the source country (the brain drain effect)[6] and/or increase it in the recipient one.[7]

2. Review of the Empirical Literature

The development of comprehensive international datasets has allowed the emergence of a large number of cross-section, time series, and panel data empirical studies of the link between gender inequality and economic growth. As in the review of the theoretical literature, we distinguish between studies that suggest a causal relationship from growth to gender inequality and those that emphasize the reverse causality.[8]

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[5] Their model is explained in more detail in Section 4.
[6] See, for instance, Mountford and Rapoport (2011).
[7] One piece of evidence consistent with this theory is Kanaiaupuni (2000) who finds that in Mexico educated women are more likely to migrate across the border seeking higher wages.
[8] Some comprehensive reviews of this literature are Klasen (2006), Abu-Ghaida and Klasen (2004). Blackden et al. (2006) review focuses on Africa.

2.1. Effects of economic growth on gender inequality

Dollar and Gatti (1999) study the impact of economic growth on the education gender gap and find strong evidence that increases in per capita income lead to reductions in gender inequality. The relationship seems to be nonlinear for secondary education: moving from being a very poor country to a lower or middle income one makes little difference in terms of gender gap. At higher stages of development though, increases in income tend to reduce this gap. The authors claim that one possible explanation for this nonlinearity is that the market failures that hinder girls' education dissipate as countries become rich enough. This paper is probably the one that addresses this question in a more credible way. Its empirical analysis is based on a well-posed and simple economic model, and its empirical conclusions are neat and clear.

Tzannatos (1999) analyzes different aspects of the link between economic growth and gender inequality. Apart from calibrating the costs of these gaps, he finds that growth benefits women at large. In particular, his results suggest that female labor participation increases with income, implying that the negative income effect is smaller than the positive substitution effect (consistent with Becker and Lewis 1973 and Becker 1981). This is the case in his analysis because, as shown in Goldin (1990) a large fraction of the increase in income comes from higher wages for women.[9] Finally, Boone (1996) finds that controlling for a country's religion adherence has a significant impact on different measures of gender inequality and reduces the role played by income per capita.[10]

2.2. Effects of gender inequality on economic growth

The typical approach to estimate the causal effect of different gender gaps on economic growth or income per capita has been to estimate regressions (cross-section, panel data, or both) of a country's growth rate of per capita income on a set of standard growth variables that include different measures of gender gap inequality. Most of these studies have found a significant negative effect of gender gap inequality on economic growth. In addition, most of these macroeconomic studies are consistent with the microeconomic literature that finds that the marginal return to education is higher for girls than for boys (Hill and King, 1995; World Bank, 2001; and King, Klasen, and Porter, 2008).

One remarkable exception is the pioneer study of Barro and Lee (1994). In this paper and in other work that followed (Barro and Lee 1996, Barro and Sala-i-Martin 2003), the authors find that when they include male and female primary and secondary schooling the coefficient

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[9] Easterly (1997) estimates a panel model and also shows that income significantly reduces the gender gap. A survey of papers that emphasize this direction of causality can be found in Stotsky (2006).

[10] Foster and Rosenzweig (2001) provide microeconomic evidence that the demand for literate wives increases in areas in which agricultural output is expected to rise. They also find that increases in the rate of technological progress reduce the preference for boys.

associated with female schooling is negative. They interpret this negative sign as a reflection of a large gap in schooling between genders, which in turn is a proxy for backwardness.[11]

In response to the puzzling finding that female education may indeed have a negative effect on economic growth a series of papers have revisited these models and found several shortcomings in the original regressions estimated by Barro and his colleagues. Some of the identified problems are the absence of regional dummy variables -particularly for Latin America and East Asia-, the use of initial period education variables, the high collinearity between male and female education, and the endogeneity of the last two variables.

One of the most careful and detailed empirical analysis of the link between the gender gap and economic growth has been carried on by Dollar and Gatti (1999). They estimate a growth equation for a hundred countries during the period 1975-1990. One interesting aspect of this paper is that it uses very diverse measures of the gender gap. In particular, they study the gender gap in education, health and life expectancy, the legal and economic equality in society and marriage, and the degree of women's empowerment. In contrast to Barro and his colleagues they find that female secondary education is positively associated with growth, whereas the impact of male education is negative although insignificant. The positive effect of female schooling is found to be nonlinear: in countries with very low female education, increasing it has no effect. However, in countries with a relatively high level of female education, increasing it boosts growth. In other words, they find that the negative effect of gender inequality on growth is concentrated among industrial countries. One interesting interpretation of this result is that gender inequality in education is a minor distortion at low levels of development (agricultural societies) but a more significant one at higher levels (more industrial societies). One important difference between their study and Barro's is that they show that the inclusion of a dummy for Latin America makes the negative sign associated with female education disappears. This seems to be driven by a combination of low growth and high female education in many Latin American countries. One conclusion of their paper is that, since a large part of the gender gap differences across countries can be explained by religion, measures of civil freedom, and regional variables, under-investment in girls schooling is not simply an efficient economic choice. Gender inequality acts more like a tax that, if large enough, should be reflected – as it in fact is - in some macroeconomic aggregate.

Klasen (2002) and Klasen and Lamanna (2009) criticize both the original Barro regressions and the approach followed by Dollar and Gatti (1999). With respect to the first set of studies they find that the negative sign associated with female education disappears once multicollinearity problems are taken into account[12] and regional dummy variables are added. These two studies use four different measures of education gender gap: the initial level of education in 1960, the gender gap in 1960, the growth in education in 1960-2000, and the growth in male-female education ratio in 1960-2000. One interesting aspect of these papers is that they are able to estimate lower and upper bounds of the effect of gender gap inequality on economic growth. When they use male education as a proxy for average education they claim to be calculating an upper-bound estimate of the effect of gender inequality on growth

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[11] Another exception is Seguino (2000a, 2000b) discussed below in more detail.

[12] To deal with multicollinearity they simply avoid including male and female education in the same regression.

since this specification implicitly assumes that one could improve the gap by educating girls more intensively while keeping boys the same. Alternatively, a lower bound can be estimated by assuming that increases in female schooling can only be achieved at the expense of less male schooling (see Knowles et al., 2002; and Klasen, 2002 for a discussion of this point). Methodologically, Klasen and Lamanna (2009) attempt to capture indirect effects of gender gap in education on growth through investment rates, population growth, and the growth in working age population. Another innovation of this paper is that they update the results of the previous literature from 1990 to 2000 and that they study also the impact of the gender inequality in employment and pay on growth. This is an important step forward since, as claimed in their analysis, the studies on employment gaps are scarce and suffer from several problems including endogeneity, unobserved heterogeneity, and poor data availability and quality. The main conclusion of their study is that the direct effect of initial gender inequality on economic growth is relatively small, while the impact of the gender inequality in the growth of education has a sizeable effect on growth.

These results differ significantly from Dollar and Gatti (1999). In particular, they do not find that the negative effect of gender inequality on growth is concentrated among industrial countries. They claim the reasons for these discrepancies are first that they use a longer time span (1960-1990 rather than 1975-1990.) Second, they use a different measure of human capital (the total years of schooling of the adult population rather than the share of the adult population with some secondary education). Finally, they claim to address multicollinearity problems that were ignored in Dollar and Gatti (1999).

Other papers that also find a negative effect of gender inequality in education on growth are Forbes (2000), Klasen (2002), Tzannatos (1999), Lorgelly and Owen (1999), Hill and King (1995), Knowles et al (2002), Yamarik and Ghosh (2003), and Abu-Ghaida and Klasen (2004).

Another strategy to estimate the effect of gender inequality on economic growth is to follow an indirect approach. Gender gap inequality may have an effect on a variable that in turn has an impact on economic growth. For instance, Bloom and Williamson (1998) emphasize that the fertility transition played an important role in explaining the growth success of East Asia. On the other hand a study by the Asian Development Bank (1997) finds that high population growth diminishes annual per capita growth in Sub-Saharan Africa by 0.7 percentage points between 1965 and 1990 and that about 15 percent of the difference in growth performance between Sub-Saharan Africa and South Asia is explained by the difference in population growth. These two studies could then be related to a large literature that shows that the gender gap in education increases population growth through increases in fertility (Hill and King 1995, Klasen 1999, Murthi, Guio, and Drèze 1995, Schultz 1994, and World Bank 2001).

Bloom and Williamson (1998) emphasize one particular indirect channel through which gender inequality can have an impact on economic growth, the so-called "demographic gift". Decreases in the education gender gap that induce lower fertility result in a reduction in the number of kids and an increase in the number of young workers working. Assuming wages do not increase much, this raise in the young labor force has a positive impact on growth. One interpretation of this result is that a larger number of workers share their wages with fewer dependents. It is important to notice though that this effect can at best be temporary: it

eventually disappears when the young workers grow old and the dependency burden increases.

Apart from the original work of Barro and his colleagues, there is a small literature that finds some positive aspects of having a sizeable gender gap. Seguino (2000a, b) shows that a reduction in the education gender gap accompanied by an unchanged gender gap in pay generates a mass of cheap and qualified female workers that may enhance economic growth. She finds that these circumstances help explain the growth performance of a sample of export-oriented middle-income countries, mostly in semi-industrialized Asian countries. One caveat with this finding is that this effect cannot last long since the associated increase in the demand for female labor will eventually exert strong pressure to increase female wages.[13] This paper is interesting because it helps reconciling the fact that many Asian countries have performed remarkably well in terms of economic growth in spite of having substantial large gender gaps in several dimensions (Seguino, 2000b; ILO, 2003), although following Stokey (1994) argument, this effect disappears once one drops Hong Kong, Singapore, Taiwan, and Korea from the sample of countries used in Seguino's papers. These were countries with a very rapid growth and very low levels of female schooling.[14] Another paper that finds advantages associated to gender discrimination is Tzannatos (1999) who cites a study on Puerto Rico that shows that patterns of gender segregation in occupation are consistent with median annual earnings of women being close to men's. One possible explanation of this result is that women may have more chances to promote if they do not work in environments together with male workers.

There is another brief strand of the literature that studies the impact of gender inequality on migration patterns. Since migration can have a potential effect on economic growth, this is yet another channel through which the gender gap may have an impact on a country's rate of growth of per capita income. Women have traditionally been ignored from the studies on immigration since they were considered complicit followers in the male migration stream. However, according to Jolly and Reeves (2005), in 1960 female migrants accounted for 47% of total migration, whereas in the year 2000 the figure was 49%. Moreover, in this period the number of women migrating independently and as main income-earners has significantly increased (Martin, 2005). In spite of these figures, the fact is that the sex of migrants is often not recorded in the official statistics.[15] This is of obviously misleading since the available empirical evidence (Zlotnik, 1995) and the theoretical models on family economics (see Browning, Chiappori, and Weiss; 2011) highlight very different push pull migration factors for men and women.

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[13] This has indeed happened in many fast-growing Asian economies (World Bank 2001, Tzannatos 1999, Horton 1994).

[14] Indeed one major problem with this paper is that the number of observations is very small (20 countries) making the results hard to interpret.

[15] The March 1990 Proceedings of the United Nations Expert Group Meeting on International Migration Policies and the Status of Female Migrants called on the need for gender specific data and analysis of migration.

The recent availability of disaggregated data has allowed several authors to study the differential behavior of women towards migration.[16] Using information on immigration to the United States, Harvey and Kaminsky (2006) measure the differential impact of gender inequality in the aggregate male and female emigration and analyze the role of different institutions on these migration patterns (see also Bueno de Mesquita, Smith, Silverson, and Morrow; 2003). However, their main goal is to document the female migration patterns to the U.S and some of their potential causes. There is no attempt on quantifying the impact of this selection of migrants on aggregate productivity in neither the source nor the recipient country. Carrasco, Jimeno, and Ortega (2008) study the impact of migration on aggregate productivity in the Spain. Borjas (2003) and Ottaviano and Peri (2011) among many others study the impact of migration on different labor market outcomes. But none of these papers analyzes the differential impact of male and female migrants.

Most of the existing empirical papers on migration with a gender component focus on its causes more than on its consequences (Curran and Rivero-Fuentes, 2003; Donato, 1993; Lauby and Stark, 1988), explain differences in assimilation patterns between men and women (Kossoudji and Ranney, 1983), or document historical patterns (Pedraza, 1991; Ravenstein, 1889; Lee, 1966).

There are several microeconomic studies of the effects of gender gaps in migration on the source countries. Pfeiffer and Taylor (2007) focus on the impact of male-female migration patterns on the members of rural Mexico that are left behind.[17] In particular, they analyze the effect of the gender of international migrants on the household's participation in cropping and non-cropping activities and the impact of female and male migration on household investments in education and health. Jolly and Reeves (2005) provide some evidence on the claim that the sex-segregated labor market influences which professional categories are able to migrate. For instance, they document that the flow of nurses from less developed countries to high or middle-income ones is mostly females, whereas males represent the majority of the flow of scientists, engineers and doctors. Ho (2004) claims that Chinese migration to Australia reveals an important "brain waste" since relatively highly educated women end up working in very low-skilled jobs. This is especially true for women who migrate in order to accompany their spouses.

In summary, although there is strong evidence of gender differences in the patterns of migration in developing countries, there are no comprehensive studies of the impact of these differences on aggregate outcomes (productivity or growth) on neither source nor recipient countries.

3. Caveats and Drawbacks of the Existing Literature

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[16] Carling (2005) provides a literature review of the gender dimensions of international migration. One good source of data is the UN's 2004 Survey on Women and Migration (see United Nations, 2005).
[17] Similarly, De Haas and Van Rooij (2010) study the impact of internal and international migration on the women that stay in Morocco.

3.1. Theoretical studies

Many of the existing theoretical studies are focused on explaining the effects of economic growth on the gender gap. In general, the authors seem to agree that economic growth affects gender equality positively, although there is an open debate about whether policy intervention is also necessary to eliminate the gender gap. Most of the theoretical explanations of the positive impact of economic growth in reducing the gender gap rely on the idea that economic growth increases the returns to human capital investment.[18] As a result, the opportunity cost of women not having access to education increases with development, which then makes discrimination more costly. Moreover, higher returns to education imply that parents find now optimal to reduce fertility and increase the investment of children's human capital, which also facilitates the participation of mothers in the labor force.

Some of the theoretical articles also study the reverse effect, i.e. the effect of gender inequality on development. Most of the theoretical explanations for the positive effects of gender equality on growth are related to the fertility and children's human capital channels. Namely, an increase in women's relative wage increases the cost of raising children, which lowers population growth and increases education levels. This, in turn, leads to higher labor productivity and higher growth in the future.

Surprisingly, however, there has been very little theoretical work on the female labor productivity channel, i.e. on the negative effects for current aggregate productivity of gender discrimination in the labor market and education. Intuitively, given that the agents' ability is distributed randomly, one would expect gender discrimination in the labor market to distort the allocation of productive resources and impact negatively the aggregate productivity. Esteve-Volart (2009) is a notable exception, since she develops a model in which agents are born with different managerial talent. In this context, labor market discrimination leads to lower average managerial talent, lower female human capital accumulation, and also lower economic growth because of its effects on technology adoption and innovation. The model, however, is only used to derive qualitative results and does not provide numerical exercises to quantify the effects of discrimination on labor productivity.

3.2. Empirical studies

Some of the problems we list below have – to some extent - been addressed in the literature. Others are completely ignored. We begin with the former and then describe the latter in some detail.

1.   *Identification of different channels*

One clear difficulty associated with the existing empirical exercises that attempt to estimate the effect of different gender gaps on economic growth is that it is often difficult to identify

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[18] This is not the case in Greenwood et al (2005) and Fernandez (2009), as explained in section 1.1.

the precise channel through which the effect takes place. For instance, as claimed in Klasen and Lamanna (2009), a finding that gaps in gender inequality in education have a negative impact on growth can be used as a rationale to promote education policies that narrow these differences. However, if there still are significant barriers to employment for females (as it is the case in many in Middle East and Northern African and South Asian countries) this policy may be quite ineffective. One strategy to address this issue is to estimate systems of equations in an attempt to identify each of these channels. This is the approach followed in Klasen and Lamanna (2008). This ambitious strategy has the important shortcoming of making the coefficients very hard to interpret because all or most variables are related to each other. We believe a reduced form approach like the one followed by Dollar and Gatti (1999), while less ambitious, is more realistic and useful for policy prescriptions. Their strategy is to simply estimate an equation where the gender gap affects economic growth and one in which a country's level of income has an impact on this gap. A compromise between the two approaches is to estimate alternative reduced formed models that are derived from well-posed economic models. These models can be very diverse and emphasize specific channels.

2. *Reverse causality and omitted variables*

This problem has been acknowledged by most of the literature. The typical way of addressing it has been the use of instrumental variables that often include the initial values of the endogenous variables and other socioeconomic indicators. While the validity of these technique is defended in most papers, these instruments are far from perfect, and therefore, it is convenient to continue the search for suitable variables that help improve identification problems. One original attempt is carried on in Esteve-Volart (2008), who estimates a regression using data from a panel of Indian states where the dependent variable is income per capita. She instruments gender gaps in employment using the ratio of female-to-male teachers. The implicit assumption is that having more females as teachers eliminates prejudices against female labor force participation, and that there is no direct effect of this ratio on a state's income level. This is a plausible and ingenious instrument but it seems problematic to find reliable and comparable information on the ratio of female-to-male teachers in cross-country analysis.

Related to this, Klasen and Lamanna (2009) claim that it is very hard to come up with valid instruments when one analyzes the gender gap in labor force participation and indeed they do not use any instrument in the estimation of their system of equations. Instrumenting the gender gap in schooling on the other hand seems more feasible. Klasen (2002) uses as instruments for changes in educational attainment different measures of educational spending, initial fertility levels, and changes in total fertility rates. While these instruments pass the standard tests, they are often hard to interpret. For example, it is not obvious that educational spending has an effect on a country's economic growth only through the change in educational attainment.

Dollar and Gatti (1999) estimate an equation to determine the gender gap and another one using the growth of per capita income as the dependent variable. Their source of possible instruments comes from the fact that the set of explanatory variables is not identical in the two equations. Two of the instruments they use are the rule of law and the black market premium, which are shown to be uncorrelated with the gender gap but help predicting

economic growth. On the other hand, the instruments they use to estimate the impact of per capita income on the gender gap are the percentage of followers of different religions and an indicator of civil liberties. They claim these are appropriate instruments since they affect growth of per capita income only through their impact on the gender gap. This strategy to choose valid instruments seems the most orthodox one and we think it is worth exploring how other variables affect the two equations discussed in their empirical model.

Forbes (2000) and Caselli, Esquivel, and Leffort (1996) use GMM techniques to instrument for gender gap inequality and find a positive effect on female education and a negative one on male education. However, it has been reported in several empirical studies – not necessarily related to the topic of this report – that these instruments are often weak.

3. *Measurement error*

The first source of measurement error in the empirical studies of the link between the gender gap and economic growth is the international nature of the data used in most studies. International comparability of data is problematic for almost all the gender gap indicators used in the literature: labor force participation, formal sector employment rates, education, and wages. With respect to schooling, we believe that most studies could benefit from the updated and revised datasets on cross-country education indicators from Cohen and Soto (2007), Barro and Lee (2010), Morrison and Murtin (2009), and Lutz, Goujon, and Sanderson (2007). Klasen and Lamanna (2009) argue that one possible way to alleviate problems of data comparability across countries is to include country fixed effects in the panel regressions. The validity of this technique hinges on the –difficult to test- assumption that problems of comparability affect levels but not trends over time.

Lack of data for developing countries is a related problem which may be harder to solve. Tzannatos (1999), for example, claims that the increase in female labor participation in countries like Angola, Mozambique, Guinea-Bissau, Dominican Republic, Turkey, or India is often the result of some statistical artifact or to the arbitrary frontier between what constitutes work and what not in different countries and over time.

4. *Multicollinearity*

Although problems of multicollinearity are often considered as having second-order effects, there are a few tests and techniques that could be used to alleviate them. These methods are more orthodox than the ones used in most of the literature. An example of a potential problem of multicollinearity is reported in Klasen (2002). Since male and female education levels are highly correlated the inclusion of the two measures as regressors in the same equation may difficult the identification of each individual effect. As mentioned above, a first strategy to deal with the choice of variables to be used in the regression is to base the reduced form equations in well-posed economic models that are specific about which variable should be included in the estimation. Alternatively, one can use specific tests that are described in detail in Greene (1997, p. 418).

5. *The choice of the gender gap indicator*

The choice of different measures of the gender gap explains in part the divergent results of, for instance, Dollar and Gatti (1999) and Klasen and Lamanna (2008). The dependent variable of the former paper is "the share of adults who have exactly achieved some secondary education". According to Klasen (2002) this variable is problematic because it ignores people who have completed secondary education or even have some tertiary education. While we think this is a valid critique, we would favor the use of different measures as robustness checks, acknowledging the pros and cons of each of them.

6. *The choice of the time period*

The choice of the time span over which the relationship between gender inequality and growth is analyzed seems to be important.[19] For instance, Klasen (2002) argues that the 1975-1990 (and even more 1980-1990) were turbulent times for many developing countries and therefore variables that should matter in the long run – like presumably the gender gap- do not appear to have a significant effect in time periods. A more orthodox way of dealing with these aggregate effects is to include a time trend or year dummies as additional regressors.

7. The importance of outliers

Given the limited number of observations in many of these studies, it is not surprising that the presence of outliers may often drive the results. This point has been raised by Stokey (1994) and Lorgelly and Owen (1999) among others. The latter offers several methods to deal with this problem in a systematic way.

The following issues have, to our knowledge, not been explored at all in the existing empirical studies:

8. *The Renelt and Levine critique*

One of the main criticisms of the so called Barro regressions is that when one applies the extreme-bound analysis suggested by Levine and Renelt (1992) very few variables seem to be robustly correlated with economic growth. Sala-i-Martin, Doppelhoffer, and Miller (2003) proposed a Bayesian technique to find the covariates that are the most robust ones in these type of regressions. Their results suggest that the gender gap - in education at least - is not in the list of these robust determinants of growth. However, it would be worth exploring whether the different indicators used since their paper are indeed significant regressors.

9. *The importance of within-country growth variation*

Several recent papers have emphasized the importance of accounting for variation of growth within a country as opposed to simply studying period averages (as it is done in the typical "Barro regressions"). One strategy to account for this variability is to use panel techniques. A different one – that has been completely ignored in the gender gap-growth literature – is to study the determinants of economic miracles and disasters (see for instance Pritchett, 2000; Hausmann, Pritchett and Rodrik 2005; Jerzmanowski, 2006; Jones and Olken 2008, and

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[19] See the discussion in Klasen (2002) to justify in part why his results differ from Dollar and Gatti (1999).

Cuberes and Jerzmanowski 2009). It would be very informative to study to what extent changes in gender gap inequality may be important drivers of these structural changes in economic growth.

10. *Composition and selection effects*

Alderman, Behrmann, Khan, Ross, and Sabot (1995, 1996), Hill and King (1995), and World Bank (2001) raise the concern that the finding that the marginal returns to education are higher for girls than for boys may in part reflect selection effects -only the most able girls end up being educated. Related to this Mulligan and Rubinstein (2008) show that in the United States a growing wage inequality within gender (for both males and females) is consistent with increasing wage inequality between genders if the majority of the apparent narrowing of the gender gap reflects changes in female workforce composition. In other words, the decline in the gender gap may somewhat be overstated due to selection effects. It is not that the average woman is now less discriminated but rather that the most able women enter the labor market (pushed by the increase in wage inequality within women), and that, as a result, the gender wage gap is reduced. Conditioning on data availability, accounting for these potential composition effects in developing countries may unfold possible biases of the effect of the gender gap on economic growth.

4. A Model of Talent Allocation under Gender Inequality

Cuberes and Teignier (2011) build a model of talent allocation based in Lucas (1978). The Lucas model solves the problem of how to allocate the productive factors over managers of different ability levels. Agents are endowed with a managerial talent drawn from a fixed distribution, and the most talented ones become managers, who are able to manage some labor and capital. One could then study the quantitative effects of these exogenous policies on average labor productivity and firms' size. When women are excluded from managerial positions, more men become managers, and the average talent of managers decreases. This reduces aggregate productivity and workers' wages. Moreover, since women are forced to be workers, the supply of workers increases and the equilibrium wage rate decreases even further.

This is similar to the model presented in Esteve-Volart (2009), which is a version of Rosen (1982). It endogenizes both labor occupation in different sectors (managerial, worker, and home production) as well as the acquisition of human capital. Moreover, it allows for technological progress induced by R&D activities. There are some important differences of the model in Cuberes and Teignier (2011) and the model in Esteve-Volart (2009). First, the model developed in Cuberes and Teignier (2011) is much more parsimonious since education is taken as given and there is no technological progress or R&D. Second, the framework in Cuberes and Teignier (2011) provides a simple and neat mechanism through which gender discrimination affects productivity. Last but not least, the framework in Cuberes and Teignier (2011) makes possible to parametrize the model and simulate the aggregate effects of different degrees of gender discrimination.

To quantify the effects of gender discrimination on resource allocation and aggregate productivity, Cuberes and Teignier (2011) fist introduces discrimination as an exogenous restriction to women's access to managerial positions or to women's participation in the labor force. Then, the values of the model parameters are specified, and, finally, the model is simulated with and without discrimination. The results of show that the exclusion of women

from managerial positions has very significant effects on resource allocation and aggregate productivity, while the exclusion from formal employment has very large effects on income per capita.

Specifically, according to the numerical results of the paper, if all women are discriminated from managerial positions, output per worker is 76.4% of the one with no gender inequality, and the wage of workers is 75.6% the wage without gender inequality. In other words, the loss in output per worker is almost 25% and the worker's wage loss is slightly higher.[20] On the other hand, when all women are excluded from the labor force, the income per capita ratio with respect to the no-exclusion case is 62%, so the loss in income per capita is almost 40%.

In the country-by-country analysis, Cuberes and Teignier (2011) find that gender gaps do not differ much across income groups, but there are very important differences across geographical regions. Their model predicts that manager's gender inequality creates an average loss of 8.5% of these countries GDP per capita. The percentage of women that are excluded from the labor force is 25%, which generates an output loss of 8.2%. The sum of these two output losses gives the total income loss due to gender gaps in the labor market. Perhaps somewhat surprisingly the results for the other three income groups are quite similar to the ones just described. for instance, high-income countries have a large gender gap in managerial positions but a small one in terms of labor force. This results in a total output loss of 19%, quite similar to the one in other income groups. The region with larger income losses due to gender gaps in labor force and managerial positions is Middle East and North Africa. According to their estimates, in this region the managerial gap is 47% whereas the labor participation gap is 66%. These differences between men and women generate a total income loss of 32%, which can be split between managerial gaps and labor force participation gaps in 10% and 22%, respectively. Europe and Central Asia display the largest gap in managerial positions (48.8%), which is quite surprising given the fact that the gap in labor force participation in this region is quite low (22.8%). South Asia also has large income losses due to gender gaps, mostly due to its large gender gap in labor force participation.

These quantitative estimates can be compared to aggregate estimations from other studies, some of which, in our opinion, are not very rigorously performed. Lofstrom (2009), for instance, finds that gender equality in the labor market would increase GDP by 40% in Malta BUT THIS IS ABOUT THE SAME AS WE FIND, RIGHT?, Greece, and the Netherlands, and the average EU GDP would increase by almost 30% if women worked on the same terms as men. To get these results, the author makes the female activity rate becomes equal to that of men, women's part-time work decline to the level of men's in each respective country, and women's productivity become equal to that of men in each respective country. General equilibrium effects, however, are completely ignored and the marginal productivity of labor is assumed to be completely constant, which is likely to lead the author to overestimate the effects of gender equality.

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[20] When interpreting the results, it is important to keep in mind that we are assuming that men and women have exactly the same talent distribution. This assumption may not be very accurate for some developing countries in which women have less education than men and, as a result, they are likely to be less skilled. These results, thus, are capturing the effects of gender inequality in access to managerial positions as well as access to those education programs that give the necessary skills to become managers.

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