GENDER AS A MACROECONOMIC VARIABLE
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Introduction

This chapter will analyse how gender can be used in a meaningful way in macroeconomic analysis. The challenge is that gender cannot be measured easily at the macro level. This is either because current gender variables are one-dimensional and miss out much gender –relevant information, or because relevant gender variables are available only for a small group of countries and a limited number of years. Another reason why gender is so much absent in macro economics is that it is not recognized as part and parcel of economic processes and policies. At most, it is recognized to be a minor influential exogenous variable – not part of the economic system. Hence, when we do see gender appearing in macro-level analysis it is in a rather limited way, for example in country level poverty analyses, where one or more gender-aware Millennium Development Goals are included, or in cross-country labour market studies in which differences in male and female labour force participation or the gender wage gap are included. For example, in a study on the economic losses of missing the Millennium Development Goals on gender equality, Klasen and Abu-Ghaida (2004) have calculated that off-track countries are likely to suffer between 0.1 and 0.3 percentage points per capita growth. Another example is shown in various analyses on EU economic growth in relation to an increasing dependency ratio due to the aging population. In such studies the relatively low female labour force participation rate has been identified as a constraint on economic growth and on the financial sustainability of pension systems. But this treats gender relations and gender inequalities simply as constraint on economic development, not as a variable that is partly determined in the economy itself.

The problem when gender is so marginalized in macroeconomic research is that it remains invisible at the macro level of research and policy advise. Trade analysis, growth decompositions, economic reform policy, and poverty reduction strategies therefore still remain gender blind, and therefore often incomplete or ineffective (see for analyses of such gender-blind macroeconomic analysis, van Staveren et. al, 2007 on trade, van Staveren 2008 on poverty, and Berik et. al, 2011 on growth). For example, the collaborative volume that I co-edited with Diane Elson and two other colleagues, on gender and trade shows that the gender division of labour in the household, asymmetric gendered institutions affecting economic behavior of women and men, and labour market discrimination have significant economic effects. They limit gains from trade, reduce the supply

response to exchange rate policy, support an exploitative competitive advantage, generate a trade-off between job gain and job security for women, and allow both competitive and concentrated industry to exploit the gender wage gap and women's weaker labour market position in strategic responses to globalization.

Instead of regarding gender as a minor, and mostly exogenous variable at the macro-level, I argue that gender must be understood as, first, shaping market processes in terms of access to and control over resources, such as education or incomes, second, as shaping people's choices and opportunities and constraints, for example in segmented labour markets with typically feminine and masculine jobs, third, as being inherently part of macroeconomic trends, for example through fluctuations in the female labour force participation rate, and forth as underlying the household gender division of labour leading to a large female intensive unpaid economy (van Staveren, 2011).

For the measurement of gender at the macro-level, we often need to go beyond a single dimension, simply because gender inequalities are everywhere: in access to resources, in discrimination and exploitation, in opportunities, in wellbeing, and in institutions. Therefore, several country-level measures of gender inequality, of gendered norms and values, and of gendered institutions have been developed over the past two decades. Indices, rather than single variables, represent broad-based measurement and can therefore include gender inequalities in a variety of economic, social, and governance areas. Well-known examples are the Gender Development Index and the Gender Empowerment Measure, both developed and published annually by the UNDP up to 2009. (In 2010 UNDP has developed an alternative in one variable, the Gender Inequality Index.) Other measures are included in broader databases such as the OECD online Gender and Institutions Database and in the Indices of Social Development by the Institute of Social Studies.

In this chapter, I will argue that such broad-based gender indices are suitable measures for macroeconomic analysis, but that they have their limitations. Below, I will introduce and compare five gender indices that are available in databases. Then I will analyse the extent to which the gender indices are related to key macroeconomic variables in a cross-country bi-variate regression analysis. Second, I will develop a disaggregate multivariate regression analysis of one of the gender indices, namely the one for which data is available for five years. The results indicate that there are different effects for different underlying indicators. More precisely, there are different effects for allocation variables, which measure contributions to economic outcomes, such as education, as compared to distribution variables, which measure conflicts over the distribution of economic outcomes, such as the gender wage gap.

This chapter points out that gender indices are well suited to track and monitor effects of macroeconomic policies and trends. At the same time, they may be less suitable to explain complex macroeconomic outcomes such as economic growth, precisely because they measure so many things at the same time. I will therefore conclude that gender indices are a useful tool for engendering macroeconomics, but they cannot replace individual, single-dimension gender variables, which have not only value for micro analysis but also for particular macro-level research questions. Indeed, because

gender is part of so many economic dimensions, it deserves to be measured both in a composite way and in single dimensions.

Five Gender Indices

The gender indices that I have selected are all recent composite indices of gender inequality. The criteria for selecting these five are wide accessibility (they are all available online), reputable sources, and many country observations included (between 101 and 184). Moreover, they are all up to date, with GII replacing the old GDI and GEM, and four indices being published for the first time in 2010 and one since 2006. I use data for the year 2010, though many underlying indicators have values for one or two years earlier due to lack of more recent data. The gender indices used in the analysis are the following:

1. GEI:

Gender Equality Index, from the Indices of Social Development database of the Institute of Social Studies (part of Erasmus University Rotterdam). The GEI was first published in 2010. The values lie between 0 and 1, with seven digits after the decimal point, and the higher the number, the more equal gender relations are. The index consist of 21 indicators. They are available for 184 countries.

2. GII:

Gender Inequality Index, from the UNDP Human Development Reports. The GII was first published in 2010 and has replaced the two earlier gender indices, the Gender Development Index and the Gender Empowerment Index, that were first published in 1995. The values lie between 0 and 1, with three digits after the decimal point, and the higher the number, the more unequal gender relations are. The index consist of 5 indicators. They are available for 138 countries.

3. SIGI:

Social Institutions and Gender Index, SIGI, was developed in 2010 on the basis of the Gender and Institutions Database by the OECD. The values lie between 0 and 1, with seven digits after the decimal point, and the higher the number, the more unequal gender relations are. The index consist of 12 indicators. They are available for 101 countries – only developing countries.

4. GGGI:

Global Gender Gap Index, developed by the World Economic Forum, since 2006. The GGGI has values between 0 and 1, with four digits after the decimal point, and the higher the number, the more equal gender relations are. The index consist of 14 indicators. They are available for 134 countries.

5. WEOI:

Women's Economic Opportunities Index, developed by the Economic Intelligence Unit. The WEOI was first published in 2010. The values lie between 0 and 100, with two digits after the decimal point, and the higher the number, the more equal gender relations are. The index consist of 26 indicators. They are available for 184 countries. In order to make them comparable with the other four indices, they are divided by 100, to give a number between 0 and 1 with four digits after the decimal point.

Table 1. Pearson correlations of the gender indices

	GEI	GII	SIGI	GGGI	WEOI
GEI	1.00	-0.75	-0.77	0.79	0.72
GII	-0.75	1.00	0.50	-0.61	-0.81
SIGI	-0.77	0.50	1.00	-0.66	-0.64
GGGI	0.79	-0.61	-0.66	1.00	0.65
WEOI	0.72	-0.81	-0.64	0.65	1.00

Note: all correlations are statistically significant at the 1% level.

The bi-variate Pearson correlations between all five indices are modest but relatively high in some cases, between 0.50 and 0.81, with an average correlation of 0.69, see table 1. Most indices correlate positively with each other, while GII and SIGI correlate positively with each other but negatively with the other three indicators, because the more unequal gender relations are according to these two indices, the higher the value of the index is. One would assume that the overlaps are largely due to duplications of underlying indicators. Surprisingly, this is not the case. On average, only 20% of the underlying indicators occur in two or more of the five gender indices.

Another interesting finding from the descriptive statistical analysis of the gender indices is that their relationships are not entirely linear. This can most probably be attributed to the fact that they measure different dimensions of inequality, varying from access to resources and capabilities to institutional constraints (formal ones through laws, and informal ones though norms and attitudes) and wellbeing outcomes. I have plotted all ten pairs of gender indices and found that in all cases the nonlinear relationship is stronger than the linear one. The three diagrams below show scatter plots and regression lines for those pairs of gender indices, which show the strongest relationships.

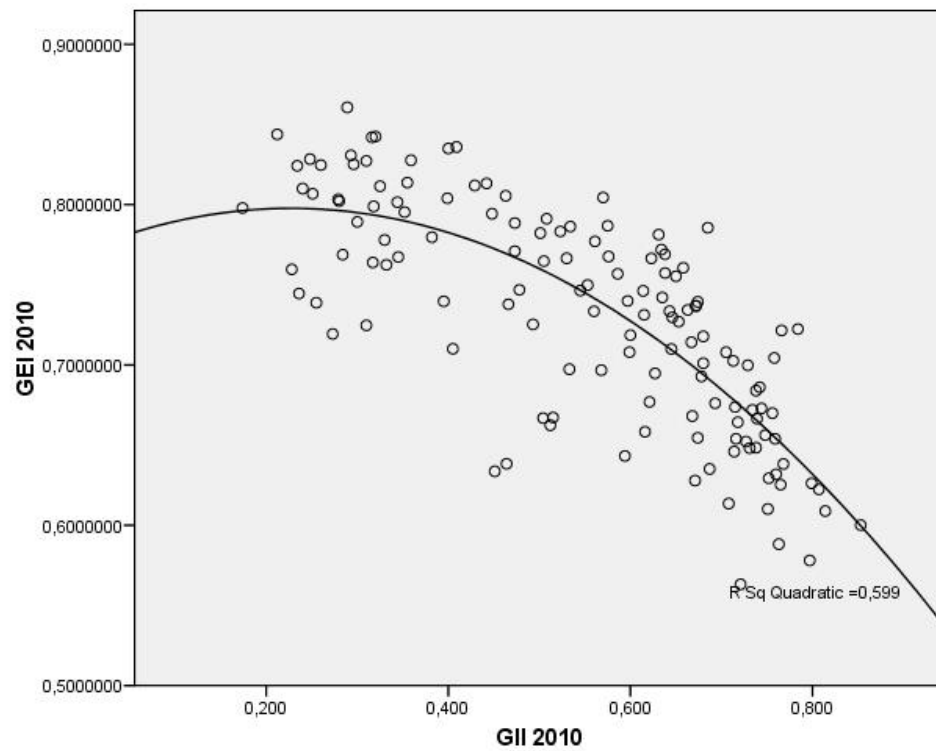**Diagram 1. Scatter plot and nonlinear regression line between GII and GEI**

Diagram 2. Scatter plot and nonlinear regression line between WEOI and SIGI
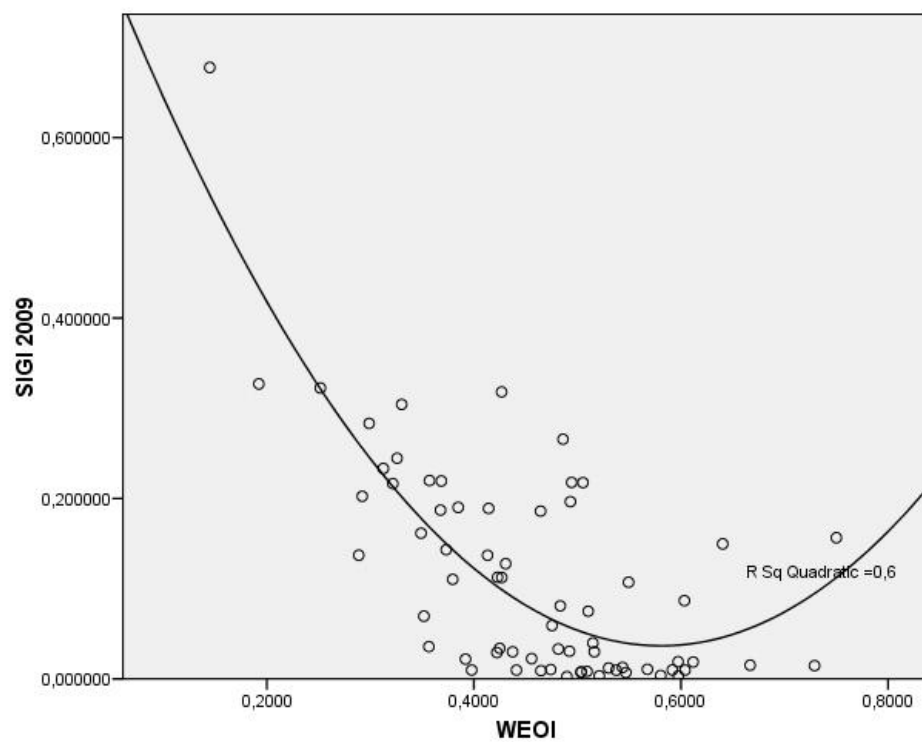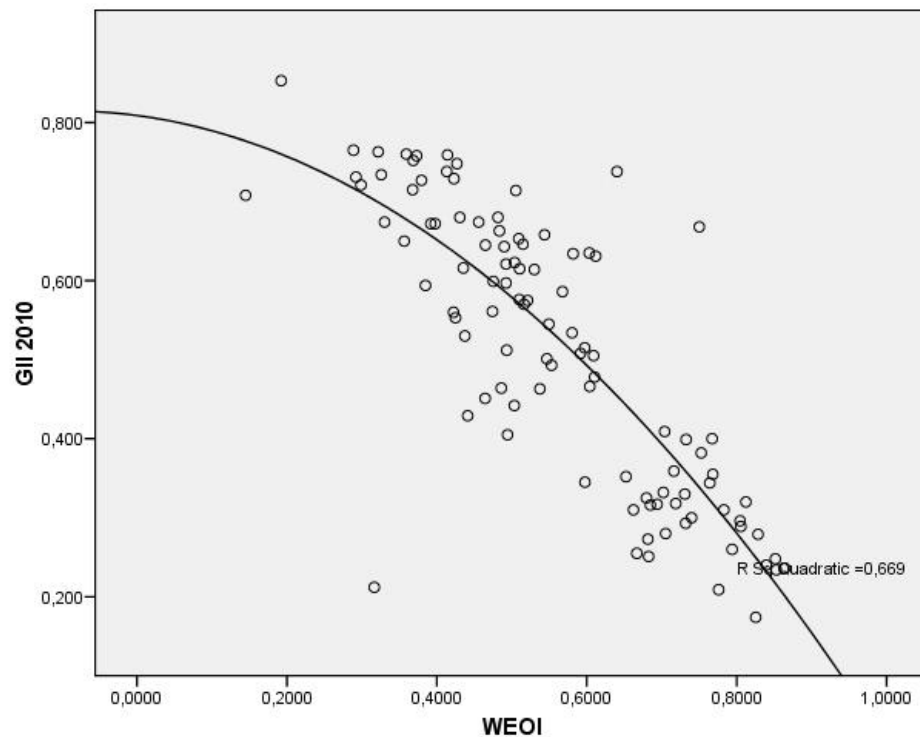
Diagram 3. Scatter plot and nonlinear regression line between WEOI and GII

Methodological Differences between the Indices

The main methodological differences considering measurement of the indices are the following:
-   weights given to the different components of indices
-   how a method deals with missing values for particular countries and years, and
-   whether a method makes use of capping the values of variables to gender equality, or whether they allow for indices that include when women have an advantage over men (for example in life expectancy or secondary school enrolment as is the case in various developed and developing countries).

Obviously, gender indices are constructed precisely as indices of inequality, by comparing male-female values for indicators and including specific indicators for dimensions that signal gender inequality, like, for example, the sex ratio in a population, the extent of early marriage of girls, and people's views about women's roles. WEOI is the only index that does not measure gender gaps but constraints to women's economic opportunities as well as indicators for the general business environment for men and women in a country. Before I will go into the three methodological issues listed above, I would first like to briefly discuss two measurement concerns.

A first measurement problem that we find among the gender indices is that one index, GGGI, includes income, as the gender differences in earned income. However, earned income is in most country statistics an estimated value based on data on labour force participation and wage differences.

Hence, it would be better to replace the income variable with a female labour force participation variable (see also Klasen and Schüler, 2011). GGGI, however, includes both, which implies a tautology. The number of indicators also influences their relative importance, in comparison with other indices. Here, we see a second difference arising among the gender indices: two indices include a relatively small number of variables, as compared to the other three. This implies that each variable in those two indices – SIGI and GII – count more as compared to individual indicators in the other three indices.

On the methodological issues raised, let's first discuss the different ways they deal with gender differences that favour women, for example in the case of life expectancy for most countries and for a few countries where women have higher school enrolment rates in secondary and/or tertiary education. GII allows for compensation of female disadvantage by male disadvantage, whereas the other indices use a cap, treating any advantage of women over men the same as an equal score for both sexes. Hence, only GII is genuine gender index, because it measures gender differences, irrespective whether they are to the benefit of men of women. The other four gender indices are actually gender equality indices fro a feminist perspective, measuring the extent to which a country is away from parity.

On the question on equal or unequal weights for the component in the indices, we find that all but one indicator is inequality averse. In SIGI high inequalities count stronger than low inequalities, by using squared values of the sub-indices in order to obtain the general index. So, the stronger inequality, the more disproportionally lower the country score is on SIGI. Moreover, weights imply value judgments, namely about the relative importance of indicators in an index and the extent to which they measure quite similar things or not – issues of breadth and depth. Weights can be applied at two levels: between categories of indicators (sub-indices) and between individual indicators. Two gender indices use weights in sub-indices: SIGI and GGGI. There is a second way in which weights come into the calculation of an index. If averages are calculated using a simple average (arithmetic mean), indicators with a higher standard deviation would receive more weight. That implies, for example, that when values are more spread, for example on school enrolment, educational indicators receive more weight in the total index than other indicators, for example on health or political representation.

Finally, on the issue of ranking: the averaging of the indices, leading to country rankings per year, differs. Whereas four out of the five gender indices take a mean value of all the underlying indicators, the GEI uses a different statistical method, namely matching percentiles. This is a ranking method in which each additional indicator adapts the previous ranking, a method that is repeated 1,000 times (Monte Carlo simulation) with a randomly chosen master variable, the first variable for which the country ranking is done and which is adapted with the additional of more indicators. This method can better deal with missing variables than the averaging method and also provides a measure for the reliability of each country score through a standard error. The GEI is calculated with minimally three data points per country, and since it uses 21 indicators, almost every country of the world is represented, with known probabilities indicated by the standard errors that are provided with the country scores as separate statistics.

The methodological differences as well as the measurement differences that I have discussed here indicate that, even though all indices have values between 0 and 1, their construction varies considerably. This has implications for the use of the indices, both for tracking and monitoring purposes of gender equality, as well as for quantitative analyses using the indices for studying relationships between gender and macroeconomic variables.

Bi-variate regression analysis of gender at the macroeconomic level

Over the past twenty years, feminist economists have developed the area of feminist macroeconomics. It has led to important empirical research results and theoretical insights. The literature has developed along three lines. First, a substantial amount of research has analyzed relationships between gender inequality on the one hand and macroeconomic aggregates on the other hand. In particular aggregates such as economic growth and exports. This has resulted in research on the gender effects of trade as well as the trade effects of gender relationships; research on growth effects of gender inequality; research in development economics on poverty and gender; and gender analyses of finance. Second, the literature has increasingly shown that there are two-way relationships between gender and macroeconomics. Not only gender effects of particular macroeconomic strategies, trends and policies, but also macroeconomic effects of particular patterns of gender inequality or of particular gender policies. Indeed, wage discrimination in labour markets have boosted Balance of Payments of labour intensive export-oriented countries, whereas low female human capital and labour force participation have constrained economic growth rates everywhere. Third, impact analyses of macroeconomic strategies and policies have demonstrated that if these policies have been designed and implemented in a gender-blind way, they often lead to negative effects on gender equality or women's empowerment. This is the case of Structural Adjustment Programs as well as Poverty Reduction Strategies, but also the crisis response packages to the financial crisis in Europe. All three strands of the literature on gender and macroeconomics, however, have shown that under particular conditions, macroeconomic policy can both benefit gender equality and macroeconomic outcomes, such as growth, gains from trade, employment, and investment (van Staveren et al., 2007; Berik et al., 2011).

This chapter tries to bring some structure in the discussion, thanks to the availability of the five gender indices and underlying gender indicators. The two diagrams below show two scatter plots with fit lines for two major macroeconomic variables: GDP per capita and GDP growth and for all countries for which data is available. I have selected the relationships with R square higher than 0.30 and for the gender index which shows the best fit with each of the two macroeconomic variables. The strongest relationships appear to be nonlinear, as was also the case for the relationships between the gender indices, shown above. This indicates that for some countries and time periods, there is a win-win relationship between gender equality and GDP, whereas for other countries and time periods, this is not

the case, or at least, the relationship is much weaker. The implication of this finding is that the relationships between gender and macroeconomics are complex, and require contextualized analysis.

Diagram 4. Scatter plot and fit line for GDP and gender inequality
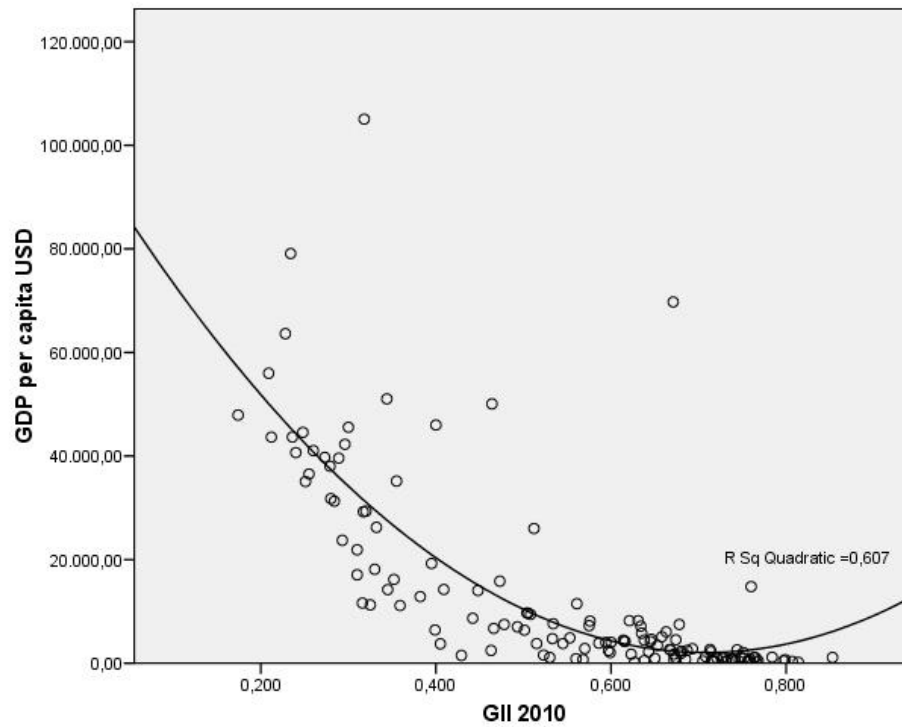
Note: GII is measured negatively: the higher GII, the more inequality.

Diagram 5. Scatter plot and fit line for GDP growth and gender equality
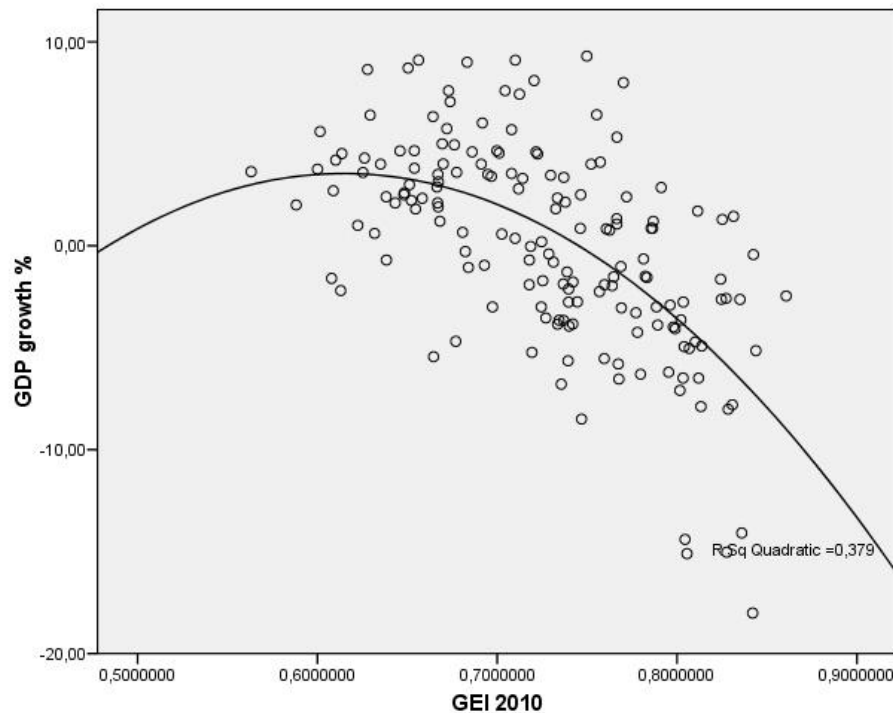
Note: The GEI is measured positively: the higher GEI, the more equality.

Diagram 4 shows that there is a relatively strong correlation between gender inequality and GDP per capita: the more inequality, the lower the level of economic development. The relationship is nonlinear, but this may be partly due to outliers. So, with more gender equality we also see higher levels of economic development. This suggests that women's human resources are better used with more gender equality, which contributes to higher levels of GDP per capita. It may also imply that economic development helps to improve gender equality, through investment in reducing gender gaps in education, health and other areas of life. Diagram 5 shows a surprising result for GDP growth. In fact, all five gender indices show a negative correlation between economic growth and gender equality, which suggests that the negative sign of the relationship is robust. So, whereas gender equality is positively related to the *level* of economic development, it is negatively correlated with the *increase* in economic development. The faster economic growth, the lower gender inequality, implying that the benefits of growth do not reduce gender gaps, or, alternatively, that more gender equality is costly for fast growth. The outliers in diagram 5 showing high gender inequality with medium and high economic growth are all Arab countries. The two outliers on the other side, with high growth and low gender inequality, are Norway and Luxembourg. The first one also oil-rich but having a diversified economy and using its oil revenues for public social investment, and the second country specializing in the financial sector, with less inclusion of women in the economy but low social and political gender inequalities due to effective social policies. Apparently, economic growth can be achieved with substantial gender inequalities, while at the same time, gender equality doe snit necessarily limit growth.

The negative bi-variate relationship between GEI and GDP growth may be explained in a political economy perspective. The literature points out that there is a negative relationship between economic growth based on export strategies on the one hand and the gender wage gap on the other hand (Seguino, 2000a and 2000b; See also the discussion between Schober and Winter-Ebmer, 2011 and Seguino, 2011). Research into this relationship also points out that with high growth export strategies, women's jobs tend to be more vulnerable than men's jobs due to their over-representation in vulnerable sectors of the economy (Ozler, 2007). The different relationships between gender on the one hand and GDP per capita and GDP growth on the other hand suggest that there is not a simple one-directional role of gender at the macroeconomic level. I will elaborate this by including more bi-variate relationships in my analysis with other macroeconomic variables. I will do so by presenting the results of bi-variate regressions.

In Table 2, I show the results are shown for the year 2010, the only year for which data was available for all five gender indices[1]. The bi-variate regression analyses, with every time one macroeconomic variable as dependent variable, include a constant. Table 2 shows the results, which are only indicative because of the common limitations of a bi-variate cross-country regression analysis. In particular, these types of regressions are incomplete: they include no other explanatory variables and neither control variables.

Table 2. Bi-variate regression results for gender indices and macroeconomic variables (2010)

	GEI (positively measured)	GII (negatively measured)	SIGI (negatively measured)	GGGI (positively measured)	WEOI (positively measured)
FDI inflow (USD)	0.264*** (3.589)	-0.290*** (-3.488)	-0.031 (-0.305)	0.172** (1.981)	0.255*** (2.769)
Food production index	-0.211*** (-2.860)	0.426*** (5.485)	-0.004 (-0.035)	-0.309*** (-3.726)	-0.457*** (-5.369)
Interest rate	-0.057 (-0.664)	0.142 (1.476)	0.082 (0.737)	-0.036 (-0.366)	-0.218** (-2.057)
Credit (% GDP)	0.480*** (6.998)	-0.691*** (-10.939)	-0.234** (-2.324)	0.424*** (5.295)	0.634*** (8.552)
Tax revenue (% GDP)	0.321*** (3.570)	-0.235** (-2.420)	-0.386*** (-3.290)	0.331*** (3.504)	0.386*** (3.924)
Exports (% GDP)	0.178** (2.292)	-0.342*** (-4.167)	-0.181 (-1.776)	0.110 (1.243)	0.263*** (2.829)
Capital formation % GDP	-0.41 (-1.774)	0.119 (1.362)	0.097 (0.934)	-0.204** (-2.351)	-0.309*** (-3.343)
Value added industry (% GDP)	-0.137 (-1.698)	0.065 (0.0715)	0.106 (0.999)	-0.138 (-1.522)	-0.099 (-0.997)
GDP growth (%)	-0.579*** (-9.094)	0.547*** (7.503)	0.557*** (6.530)	-0.412*** (-5.033)	-0.517*** (-6.242)
lnGDP per capita (USD)	0.596*** (9.558)	-0.841*** (-17.962)	-0.365*** (-3.826)	0.462*** (5.867)	0.794*** (13.654)
Terms of Trade (ratio)	-0.163** (-1.999)	0.147 (1.568)	0.183 (1.725)	-0.235** (-2.491)	-0.075 (-0.713)

Notes: Regressions with constant; reported are standardized coefficients (beta); t-statistics in brackets. Levels of significance: *** p<0.01; ** p<0.05.

The bi-variate regressions results reported in Table 2 indicate that in the majority of cases the correlations are statistically significant. The only economic variable that shows no statistical significant result with any of the five gender indices is value added of industry. Perhaps this is due to two contrary mechanisms: on the one hand, low women's wages reflecting and contributing to low value added in labour intensive industries, and on the other hand high women's employment shares in labour intensive industry enabling perhaps higher value added than in agriculture which in many, though certainly not all countries is male intensive. Checking the signs of all bi-variate estimations, the table shows that most of these are as expected. The positive relationships are the following: FDI (+), the interest rate (-)[2], domestic credit (+), tax revenue (+), exports (+), and GDP per capita (+). More FDI goes together with more gender equality, probably through increasing female employment shares in manufacturing. The availability of more domestic credit parallels gender equality, perhaps because of more access to credit by female entrepreneurs. Tax revenues increase with more gender equality, probably through the labour market participation of women, which crowds in female tax payment. Higher exports and higher gender equality go hand in hand, again most likely through the higher female share in manufacturing employment, contributing to cheap labour export strategies. Finally, higher gender equality goes together with higher GDP per capita, as we have seen above in diagram 4. The sign for the interest rate is negative, meaning that more equality goes together with lower interest rates, stimulating investment. This may indicate that more gender equality does not generate a risk premium on investments but may rather help the efficiency of loan allocations in credit markets. Alternatively, more lending may also extend to women, crowding in female entrepreneurship into the small and medium scale business sector.

There are four negative correlations of macroeconomic variables with gender equality: food production (-), capital formation (-), GDP growth (-) and Terms of Trade (-). For food production, the four statistically significant correlations are all negative with gender equality, indicating that higher food production in a country goes together with less gender equality – perhaps because it extracts more labour from women at low or no pay, through women's generally high participation in unpaid farm labour. At the same time, higher food production may be advantageous for urban women, because it tends to keep food prices down, and hence, the burden on women's household budgets limited. For capital formation, contrary to the availability of domestic credit, the sign is negative for the two gender indicators, GGGI and WEOI, for which the parameter is statistically significant. Apparently, capital formation goes at the cost of gender equality, or, the other way around, more gender equality reduces capital formation. This result is in line with Stephanie Seguino's (2000a and 2000b) finding that low relative women's wages in labour intensive export economies is correlated with high capital formation through returns reinvested from profits. The higher profits made possible by paying women lower wages than men allow for higher capital formation, she has argued. Hence, this may be the mechanism that the above bi-variate regression results seem to confirm, even though these results are preliminary.

A third exception of sign is for economic growth, as we already discussed above with the scatter plot in diagram 5. The literature, including the above referred to key articles by Seguino, indicates that higher growth rates for developing countries are often related to a labour intensive export strategy, which employs women at very low wages. Hence, more growth implies less gender equality in earnings. In an earlier study, I have shown with bi-variate regression analysis that there is a statistically significant positive relationship between female and male vulnerable employment on the one hand and FDI inflows and even the volatility of FDI inflows on the other hand (van Staveren, 2011). Also that result seems to be supported by the bi-variate results in table 2, namely through the channel of low labour standards through outsourcing and subcontracting. The fourth and final negative correlation with gender equality is with the Terms of Trade, which is statistically significant for four of the five gender indices. In all these cases, improved Terms of Trade correlates with less gender equality, implying, in line with the other cases of negative correlations discussed here, that better export prices, relative to import prices, go together with more inequality in women's employment conditions, most likely women's wages and/or women's employment share in vulnerable jobs.

Comparing the regressions, the statistical significance is not always for the same economic variable. Nine out of eleven economic variables is statistically significant in the WEOI, the most financial-economic defined gender index. Hence, this comes as no surprise. And only three out of eleven economic variables are statistically significant in the SIGI, the least economically defined gender index, again, as expected. This suggests that for the explanation or prediction of economic outcomes, WEOI seems a suitable gender index. This is particularly the case for financial-economic variables, such as the interest rate and capital formation, which are not statistically significant in any of the other gender indices (interest rate), or only once (capital formation). This result, however, is partly based on endogeneity effects, because the WEOI includes some non-gender disaggregated financial economic indicators similar to the economic variables included in the regressions. So, there is an overlap in dependent and independent variables, which is statistically not justifiable. This means that the potential use of WEOI for econometric analyses is rather limited. Moreover, three other gender indices come close in terms of the number of statistically significant economic variables: GEI and GGGI each have eight statistically significant economic variables and GII has seven significant economic variables. Hence, all gender indices except for SIGI appear to be adequate measures for monitoring gender effects of macroeconomic trends and policies, at least, in a preliminary regression analysis. Obviously, more detailed analysis is necessary, both in terms of adding control variables as well as in an expansion to time-series or panel data analysis. That is what I will turn to on the next section, limiting myself to only one of the five gender indices, GEI.

Multivariate Growth Regression Analysis for GEI and its Indicators

The multivariate regression analysis presented in this section focuses on one key macroeconomic variable: economic growth. This choice was made because in the bi-variate regressions, this relationship came out negative and statistically significant for all five gender indices. This finding is not consistent with some findings in the literature using particular gender indicators, such as the gender gap in education (Klasen, 1999). The analysis will be done with one gender index only, namely GEI. This is the only index for which data is available for a long period of time (twenty years, divided in five observations with every time five years in between), and for a large number of countries. The analysis makes use of panel data for four periods of average annual economic growth: 1990-1994; 1995-1999; 2000-2004; 2005-2010. The independent variables are capital as a percentage of GDP (average per period), labour force participation (average per period), and GEI or its underlying indicators (base year per period, recognizing that GEI is measured every five years with data from around the measurement year), with lnGDP per capita as a control variable (base year per period, logarithm). The method used is a fixed effects estimation, in order to address the problem of possible unobserved variables at the country level[3].

GEI consists of 21 indicators, of which 12 are likely to have an impact on economic growth and have a sufficient number of observations for the panel estimations. In order to separate the gender variables that are likely to have a positive effect on GDP growth from those that are likely to have a negative growth impact, I distinguish between allocation variables and distribution variables. The allocation variables are expected to contribute positively to economic growth by crowding in women's labour, human capital and managerial capabilities. The distribution variables reflect distributional conflicts through discrimination and exclusion, which contribute positively to economic growth (measured in the short run, for five year periods) at the cost of women, through exploitation.

Table 3 shows the results for the GDP per capita growth regression, with country fixed effects, with GEI as gender variable, for all countries and years available (n = 626).

Table 3: Growth fixed effect regression

lnGDPpc	-6.28*** (-7.19)
Capital	0.21*** (5.58)
Labour force Participation	-0.33*** (-3.36)
GEI	-3.58* (-1.69)
Constant	75.94*** (8.77)
Rsq	0.21
n	626

Notes: t-statistics in brackets; levels of significance: *** p<0.01; * p<0.1.

The results shown in table 3 indicate that all the independent variables in the growth regression are statistically significant. GDP per capita has a negative sign, which points at convergence of income levels between countries, in line with the growth literature: countries with low GDP per capita levels are likely to show higher growth levels, whereas countries with high GDP per capita levels are likely to show slower growth. Capital as a percentage of GDP has, as expected, a positive effect on growth, whereas labour force participation has a negative effect, probably because labour force participation declines with higher average levels of education, due to more years in school rather than on the labour market. GEI has a negative sign, as was expected on the basis of the scatter plot and bi-variate regression results shown in the previous section. The size of the coefficient for GEI is large, as compared to the coefficients for capital and labour, which are all three measured between zero and one and therefore comparable. The next two tables will unpack the GEI variable and show the results for the disaggregated gender variables. Table 4 gives the results for the allocation variables in GEI (gender *equality* likely to contribute to growth through crowding-in mechanisms) and table 5 for the distribution variables in GEI (gender *inequality* likely to contribute to growth through exploitation of women).

Table 4: Growth fixed effect regression results for allocation variables in GEI

	(1)	(2)	(3)	(4)	(5)	(6)
lnGDPpc	-6.96***	-4.82***	-3.92***	-5.58***	-9.41***	-9.55***
	(-8.25)	(-5.54)	(-2.71)	(-3.51)	(-4.26)	(-6.61)
Capital	0.23***	0.17***	0.10**	0.35***	0.20**	0.22***
	(6.26)	(4.97)	(2.00)	(5.67)	(2.02)	(3.92)
Labour force participation	-0.63***	-0.14	0.14	-0.53***	-0.10	-0.23**
	(-5.70)	(-1.45)	(0.85)	(-3.95)	(0.56)	(-2.54)
F/M labour force particip	0.28***					
	(5.44)					
F/M primary education		6.19				
		(1.63)				
F/M second education			7.422			
			(1.21)			
F/M tertiary education				13.30***		
				(3.04)		
F/M administrators					14.34	
					(1.27)	
F/M professionals						11.94***
						(6.87)
Constant	78.90***	44.69***	19.55	67.86***	78.67***	97.29***
	(9.11)	(4.77)	(1.16)	(4.92)	(3.72)	(7.11)
Rsq	0.24	0.21	0.11	0.24	0.26	0.33
n	640	442	235	360	136	265

Notes: R square reports the result measured within countries, which is the most relevant for fixed effects estimation, as compared to 'R square between' and 'R square overall'; t-statistics in brackets; levels of significance: *** $p<0.01$; ** $p<0.05$.

Table 4 shows the results for six regressions, each with a different allocation gender variable. We see that all the allocation gender variables have the expected positive sign: they all contribute to economic growth. They are statistically significant in three out of six cases: for the female/male ratio in labour force participation, tertiary education and professionals. So, even though the overall labour force participation rate shows a negative sign, when the female share in the labour force increases, this benefits growth. All gender variables are measured between zero and one, so that their coefficients can be compared. What is striking is that the sizes of the coefficients are relatively high for the gender education variables and the gender management variables, relative to those for the gender-neutral capital and labour variables. Gender clearly matters for growth.

The positive results can all be explained, as hypothesized, by the crowding in of female production and productivity, which benefits growth through the law of diminishing marginal returns: the stronger the inclusion of women in production, the more growth as compared to low participation of women. In other words, if an economy relies largely in male resources, growth is limited by the limited availability of additional males, and the available non-participating males are likely to be the low-productive males, otherwise they would have been hired already. Instead, highly productive females are still available, and when hired, they will boost economic growth.

Table 5: Growth fixed effect regression results for distribution variables in GEI

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
lnGDPpc	-2.45*	05.34***	-5.18***	-7.69***	-3.30	-7.10***
	(-1.93)	(-5.86)	(-5.56)	(-4.38)	(-1.44)	(-8.02)
Capital	0.25***	0.22***	0.22***	0.22	0.13	0.21***
	(3.71)	(5.55)	(5.75)	(1.66)	(0.84)	(5.17)
Labour force participation	-0.30**	-0.34***	-0.29***	-0.65***	-0.11	-0.37***
	(-2.30)	(-3.50)	(-2.85)	(-4.94)	(-0.56)	(-3.59)
F/M wage	-0.04					
	(-0.86)					
W economic rights		-0.25				
		(-0.41)				
W social rights			0.63			
			(1.23)			
Men right to job				-15.48***		
				(-4.85)		
Men better leaders					0.47	
					(0.10)	
F/M mortality						3.83
						(0.95)
Constant	42.71***	55.59***	60.39***	113.84***	37.50	80.56***
	(3.37)	(7.27)	(6.30)	(6.65)	(1.59)	(8.44)
Rsq	0.18	0.17	0.15	0.44	0.08	0.22
n	187	593	591	160	101	611

Notes: R square reports the result measured within countries, which is the most relevant for fixed effects estimation, as compared to 'R square between' and 'R square overall'; t-statistics in brackets; levels of significance: *** $p<0.01$; ** $p<0.05$; * $p<0.1$.

Table 5 shows the results for six regressions with distribution gender variables. Only one result is statistically significant and with the expected negative sign: the more people believe that men have more rights to a job than women when jobs are scarce, the lower economic growth. This form of discrimination, through a gendered institution reflecting an asymmetric norm, benefits men in employment but goes at the cost of growth. The effect is relatively large compared to the other variables in the same equation and also compared to the variables in the other equations in this table and the previous one, in which all the gender variables are measured between zero and one. Clearly, this form of gender discrimination in the labour market does not benefit growth. It points out how destructive discriminating gender norms can be for economic development.

The other five distribution gender variables are not statistically significant, but not necessary uninteresting. We find that, in line with the literature, an increase in women's relative wages as compared to men's wages reduces economic growth, because less exploitation of women results in a lower competitive cost price advantage in exports and a lower profit ratio for investment in future growth. The size of the coefficient is small, and probably varies between export-oriented countries and other countries (Blecker and Seguino, 2002). For the two rights variables, we find opposite results. Higher economic rights for women reduce growth whereas higher social rights for women increase growth. This result runs parallel to the findings by David Kucera, who found that FDI is attracted by lower female wages but also by better protection of women's labour rights (Kucera, 1999). The variable whether men make better leaders than women shows a positive relationship, indicating that the more people think that men make better leaders than women, the higher economic growth. Perhaps this points at a self-fulfilling prophesy effect of the old boys' network: the stronger this network, the higher the adaptation costs of breaking the norm. Finally, the results for the female/male mortality rate shows a positive relationship to growth, indicating a perverse effect. The more economic growth is directed towards women's health care, the slower growth. Perhaps it is only in the long run that a positive effect of better relative female health is translated into higher economic growth. Or perhaps the negative relationship indicates the higher marginal costs of investing in female health, because in most countries, women already have a longer life expectancy than males. So, making women even more healthier is relatively costly as compared to making men less unhealthy as compared to women.

Comparing tables 4 and 5, we see stronger gender effects on growth of the allocation variables than the distribution variables. All statistically significant coefficients have a positive sign for gender equality on growth (or, alternatively, a negative sign for gender inequality). So, the analysis confirms the hypothesis that more gender equality in the allocation of human resources contributes to economic growth, rather than reducing it. At the same time, some distribution variables show a negative impact on growth, but these are not statistically significant. Other distribution variables will probably show significant negative effects, but for those variables, there was insufficient data available. The analysis with the available gender variables suggests that disaggregating a gender index makes the study of gender impacts on macroeconomic variables meaningful, both empirically as well as theoretically, in cases that the composite index shows inconclusive results such as strong nonlinearities.

Conclusions

The bi-variate regression analysis indicates that the five available gender indices for the year 2010 all have many statistically significant relationships with economic variables, and in the majority of cases with expected positive signs, indicating that more gender equality correlates with better economic performance. But almost half of the economic variables show negative relationships between economic performance and gender equality. These preliminary regression results have been interpreted, with help of the literature, as related to exploitation, marginalization or exclusion of women through high use of women's unpaid family labour in food production, or high use of low wage women's labour in export industries. For these economic performance variables, there seems clearly a win-lose relationship with gender equality.

The multiple growth regression with panel data and country fixed effects has indicated a negative relationship between gender equality and growth as measured by one of the indices for which data was available for a period of twenty years (GEI). A disaggregated regression analysis with some underlying gender indicators has provided more insights into the relationships. Allocation gender variables for labour force participation, tertiary education and professionals all have a positive and statistically significant effect on growth. Of the distribution variables, only one appeared to be statistically significant, namely the gendered norm that men have more rights to a job when jobs are scarce. This had, contrary to what was expected, a negative effect on growth, suggesting an efficiency loss due to patriarchal norms and old boys networks in labour markets on growth. The other gender variables showed in most cases the expected sign: exploitation of women having a positive effect on economic growth, at least for the medium-term period analysed.

The conclusion of this chapter is that gender indices seem adequate measures for tracking and monitoring gender effects of macroeconomic trends and policies. Also, they appear to be meaningful for macroeconomic analysis of various variables, such as credit, trade, and tax revenue. Only for the analysis of one of the most complex macroeconomic variables, namely economic growth, gender indices seem to be a too broad measure to obtain meaningful results. Disaggregation into allocation variables and distribution variables appears to be more adequate for analysing the impact of gender (in)equality on growth. Hence, gender indices seem to be a useful tool for macroeconomic analysis, improving both macroeconomics as well as gender analysis, but may give inconclusive results when used in growth regressions.

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Notes

[1] These are standard Ordinary Least Squares (OLS) regressions.

[2] A negative sign for the interest rate means that lower interest rates, stimulating the economy, a correlated with more gender equality. So, substantially, this is a positive relationship between gender equality and economic development.

[3] An instrumental variable analysis appeared not meaningful, due to the lack of an appropriate instrument for GEI. An instrument is a variable that is exogenous and hence not influenced by the dependent variable. GEI is an index consisting of a broad range of indicators and therefore a constructed variable for which no suitable instrument exists. GEI is rather explained by its constitutive indicators.