Exports and Gender Specific Effects on Labor Force Participation in Indonesia*

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Abstract

We study the gender specific effects that exports might have on labor force participation using household panel data from the Indonesian Family Life Survey. We construct a novel measure – the export exposure index – which allows us to estimate this effect even after controlling for household and province-year fixed effects. We find that an increase in exports does not have a statistically significant effect on men, but encourages women to allocate time away from paid employment towards unpaid house or family work. These results are consistent with a model which predicts that the relative increase in spousal income (following an increase in export exposure) strengthens females' comparative advantage in unpaid housework and encourages them to devote more time to home production.

Keywords: Exports, Gender, Labor Force Participation.
JEL classifications: O12, F63.

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1 Introduction

One of the major goals of the United Nations is to "promote gender equality and empower women" in developing countries.[1] Women's empowerment is often interpreted as an increase in their economic freedom, self-determination, and influence over family decisions such as education, nutrition and health (Schultz, 2002). One factor that can empower women in this manner is participation in the labor force (Brown & Park, 2002). With export orientation creating job opportunities in many developing countries (e.g. World Bank, 1993, 2000), there has been a growing interest on understanding the effect that exports might have on female labor force participation. Over the past fifteen years, the view that export orientation is associated with greater female labor force participation has taken hold (see, *inter alia*, Ozler, 2000; Başlevent & Onaran, 2004; Hossain, 2011; Gaddis & Pieters, 2014), but this observation is based mainly on cross-sectional studies that lack a causal interpretation or empirical analyses that overlook the role of women at home. Here, we hope to advance this inquiry by employing rigorous panel regression analysis with Indonesian household survey data. While we find that men on average are not responsive to an increase in exports, women on average would reduce paid employment and increase unpaid house or family work. Therefore, unlike the consensus view, women may not necessarily participate more in the labor force with export orientation.

To gain some insights into our empirical work, we first construct a conceptual framework based on a simple household bargaining model. The household consists of a husband and wife (representing males and females) who both consume a market good and a household good which is produced with household labor only. Our model predicts that if men have a comparative advantage in the labor market and women in producing the household good, men will then devote all their time to working for a wage and thus have an inelastic labor supply with respect to exports. For women, our model shows that the direction in which exports affect their labor force participation depends on the relationship between exports and the relative wages of men versus women (i.e. the gender wage gap). If an increase in exports raises the gender wage gap in a way that preserves the respective comparative advantages of men and women, this would encourage women to allocate their time away from market employment towards home production. Conversely, if exports are associated with a shrinking gender wage gap, an increase in exports would encourage more women to participate in the labor force.

[1] This is the third U.N. Millennium Development Goal and fifth U.N. Sustainable Development Goal.

For the case of Indonesia, our model predicts that exports would lead to an overall decline in female labor force participation. This prediction comes from the empirical observation that in Indonesia, exports are positively associated with the relative wage of men. One possible explanation for this association is that women in Indonesia are more heavily represented in the informal sector (e.g. unpaid family workers or services) while men in the formal sector.[2] Because Indonesian exports are mainly associated with the formal sector (e.g. manufacturing), a rise in exports would increase the demand for male labor and drive up their relative wages.

With the model prediction, we use a large scale household panel dataset – the Indonesian Family Life Survey (IFLS) – to study how men or women react to exports in their decision to enter or exit the labor force, work a certain number of hours, and choose the type of labor activity (e.g. home production versus market work). To study the effect that exports might have on the labor market decisions of individuals, we have to address two technical issues. Firstly, because export is a macroeconomic variable, its effect on individuals will be confounded by the effects of unobserved regional and global macroeconomic shocks. Secondly, the difficulty of identifying the effect of exports on an individual's decision to work is compounded by the fact that these decisions are often determined jointly within a household (e.g. between husband and wife) with behaviors, norms, and abilities that are unobservable.

To address these issues, we construct an *export exposure index*, which contains information about how exposed an individual is to exports. Unlike exports, this index has *both* cross-sectional and time variation, which makes it compatible with the use of household and province-year fixed effects to eliminate the confounding household characteristics and macroeconomic shocks described above. To measure export exposure, we follow the insight that in Indonesia, manufacturing accounts for more than half of the country's total exports.[3] This, together with the fact that manufacturing in Indonesia is usually concentrated within large urban areas (Deichmann et al., 2008), imply that the variation in exports would, on average, affect individuals in cities more strongly than those than in rural areas. Therefore, our notion of export exposure is related to the closeness that an individual is from cities. To quantify this idea, first, for each province, we calculate

[2]In Indonesia, many females are engaged in unpaid family work, where such employment accounts for 36.9% among employed females in 2006 (OECD country report, Indonesia).

[3]In 2010, the share of manufacturing exports (as a proportion of total exports) was about 60%. The next largest exported good, fuels, accounts for about 25% of total exports. However, note that our trade data excludes exports of fuels, therefore, the most of exports in our data are from the manufacturing sector.

a score for the individual called the *Population Gravity Index* (PGI), which summarizes his or her proximity to all cities in the province weighted by the size (i.e. population) of these cities. Next, to construct the export exposure index for this individual, we interact his or her province-specific PGI score with the non-fuel exports (termed *exports* hereinafter) of that province, and then aggregate this interaction term over all provinces. This index amplifies the influence of exports on those residing in metropolitan areas, so that by exploiting the location specificity of individuals, we may estimate the effect of exports on individuals' labor force participation even after controlling for household and province-year dummies.

Our empirical analysis considers labor force participation along both extensive margin (i.e. whether a person participates in work) and intensive margin (i.e. the hours of work an individual puts in). We find that exports do not have a statistically significant effect on either margin of work by men, implying that their labor supply is inelastic. However, for women, we find that an increase in exports could reduce their labor force participation and increase their household and unpaid family work along both extensive and intensive margins. Therefore, even if export orientation creates more employment opportunities, our study shows that women may end up participating or working less, which concurs with our model prediction.

Our paper contributes to the literature by employing rigorous panel regression analysis to study the effect of exports on female labor force participation (along with men's). While much has been done to estimate this effect, many studies are based on cross-sectional regressions that lack a causal interpretation (e.g. Paul-Majumder and Begum, 2000; Ozler, 2000; Başlevent & Onaran, 2004; Hossain, 2011). Recognizing this problem, Gaddis & Pieters (2014) propose to exploit the variation in the exposure to tariff reductions following Brazil's trade reforms. Although they employ Brazilian household panel data to study the response of the individual, their trade exposure variable, which is their main regressor, is measured at the state level. As such, household fixed effects cannot be used to eliminate any unobserved household characteristic that could affect work decisions. Our export exposure index has household level variations; this enables us to use household fixed effects to construct what we hope is a reasonably well identified model relating exports to the labor market decisions of individuals.[4]

[4]The IFLS data provides only general information on industry where an individual works. Hence, we would not be able to use the tariff data for our analysis as we cannot match individual's labor participation data to the data on tariffs changes in the corresponding industries.

Our paper is related to the literature within the themes of female empowerment, economic development and globalization.[5] In particular, it is related to the issue of raising the labor force participation rate of women in developing countries. In poor countries, parents tend to have lower aspirations for their daughters than for their sons, and female teenagers tend to have lower aspirations for themselves (e.g. Beaman et al., 2012). If women do not work outside of home, there may be a perception that they do not need to be healthy or have a formal education (The PROBE Team, 1999). Therefore, better opportunities for women in the labor market may translate into better outcomes for women and girls and eventually more empowerment for them (Qian, 2008; Jensen, 2010 & 2012; Duflo, 2012).

On the relationship between globalization and female labor force participation, the empirical literature, based mainly on cross-country and labor survey studies, has found it inconclusive that globalization can lead to higher labor participation rates of women in developing countries. The studies that are based on cross-country data have suggested, on the one hand, that globalization is associated with increased female labor participation in developing countries (Bussman, 2009) and a positive change in social institutions related to gender equality and labor rights for women (Potrafke & Ursprung, 2012; Neumayer & Soysa, 2007). However, on the other hand, there is also evidence that these positive effects of globalization are only limited to middle-income and rich countries, and irrelevant for developing countries (Oostendorp, 2009; Neumayer & Soysa, 2011). Similarly, studies based on labor survey data have found that globalization may induce competitive effects on gender discrimination along the lines of Becker (2010) (e.g. Berik et al., 2004; Ederington et al., 2009).[6] However, there is also evidence that these pro-competitive effects of globalization are limited to blue-collar occupations (Juhn et al., 2014) and to unmarried women (Başlevent & Onaran, 2004). To the extent that exports are related to globalization, our paper adds to this literature by arguing that the comparative advantage of women in household production may lead to lower female labor force participation rates when exports increase. The fact that women are faced with the option of housework or market work has also been largely overlooked by this literature.

The rest of the paper is organized as follows. Section 2 provides some background information on Indonesia. Section 3 discusses the conceptual model that we use to gener-

[5] See Duflo (2012) for a review of this literature.

[6] In other words, competitive pressures from globalization will make it more costly for employers to discriminate against females of equal abilities as males.

ate some predictions about the relationship between exports and labor force participation. Section 4 describes data, key variables and empirical model. Section 5 discusses the results and Section 6 concludes.

2 A Background on Indonesia

Our interest in Indonesia is motivated by several factors. Firstly, exports have played an important part in transforming Indonesia's economy. From the mid-1980s, the government pursued an active export-oriented trade policy, with a reduction in tariffs and tarrification of non-trade barriers. In 1995, Indonesia became a WTO member and in the process the nominal tariffs were reduced from 17.2 percent in 1993 to 6.6 percent in 2002. Although Indonesia was significantly affected by the 1997 Asian financial crisis,[7] it managed to recover rapidly as reflected by the 15% increase in exports it posted over the pre-crisis (1990–96) average export value just merely two years after the crisis.

Secondly, the Indonesian government have been trying to put in place pro-women policies such as the Presidential Instruction Number 9/2000 on Gender Mainstreaming in National Development for integrating women's perspectives into planning by both central and local governments, compulsory education for children to reduce the gender gap at schools, etc.[8,9] Despite these efforts, the labor force participation rate of men in Indonesia remains substantially higher than that of women. For example, from 2000 to 2008, the participation rate of women fell across all age groups and from 60% to 54% on average, while the average participation rate of men stayed roughly constant at 87%. This declining trend in female labor force participation rate appears somewhat puzzling as one would expect exports, which have been rising in Indonesia, to generate more job opportunities for women.

Thirdly, Indonesia has substantial within country diversity in economic performance and geography.[10] For example, the per capita income in East Kalimantan (one of the

[7]Total value of exports fell by 6% in 1997 and 12.6% in 1998, with a significant reduction in non-oil primary and manufacturing products.

[8]According to the World Bank Gender Statistics database, the ratio of female to male students enrolled in primary schools in 1970 was 86%, in secondary schools - 53%, and the ratio in tertiary education was just 32%. By 2007, these ratios increased to almost 100%.

[9]See the UN Report: Indonesia, Overview of Achievements and Challenges in Promoting Gender Equality and Women's Empowerment.

[10]Indonesia is the world's largest archipelagic state with 13,000 islands over 34 provinces. Indonesia is also the third largest developing country after China and India.

richest provinces) is roughly 16 times that of Maluku (one of the poorest); provinces such as Aceh, Papua, Riau and East Kalimatan are rich in natural resources while Jakarta and West Java are the country's centers for finance, manufacturing and construction.[11] Moreover, West Papua and Sulawesi are highly remote with population densities of less than 10 and 97.4 people per square kilometer, respectively, while Java Island, which consists of West Java, Central Java, East Java and Banten, is the most populous island in the world with nearly 1,100 people per square kilometer (in 2014). The diversity in economic performance within Indonesia, as well as in the type of environments that individuals live in (e.g. from highly rural to highly urbanized areas), is useful in helping us construct an export exposure index that has substantial variation.

Finally, in the IFLS, Indonesia has arguably the most comprehensive household panel dataset for any developing country. This allows us to employ appropriate fixed effects strategy to address certain issues in estimating the effect of exports on individuals' labor force participation, which are discussed further in Section 4.4.

3 Conceptual Model

We develop a conceptual model to analyze the effect that exports might have on women versus men. Our framework is based on a simple collective household model that describes a couple, a husband and wife (representing males and females), jointly maximizing a household's utility function given by[12]

$$U = \mu U^f \left(H, q^f\right) + U^m \left(H, q^m\right), \tag{1}$$

where $U^f(\cdot)$ is the utility function of the wife, $U^m(\cdot)$ is the utility function of the husband, μ is a measure of the relative bargaining power of the wife,[13] H is the amount of common non-market household good consumed, and q^f and q^m are the private consumption levels of the market good. For simplicity, let the preferences of each agent over H

[11] See Hill et al. (2008).

[12] See Browning et al (2014) for an analysis of various household models, including a collective household model.

[13] Note that we assume that μ is fixed. See Browning et al (2014) for an analysis of a richer class of model where μ is endogenous.

and q be represented by the same Cobb-Douglass utility function:

$$U(H, Q, q) = AH^{\alpha}q^{1-\alpha}. \tag{2}$$

To consume H and q, the husband and wife allocate the one unit of time endowment they each have to paid market work and unpaid housework.[14] We denote the amount of husband's and wife's time devoted to the housework (or paid employment) by t^m and t^f (or $l^m = 1 - t^m$ and $l^m = 1 - t^m$) respectively. The common non-market household good (H) can be thought of as child-caring or housework; it is produced with t^m and t^f:

$$H = h\left(\rho t^f + t^m\right), \tag{3}$$

where ρ is a measure of the absolute advantage in producing H the wife has, and $h(\cdot)$ is an increasing and concave function. The amount of the private good consumed by the husband and wife (i.e. q^m and q^f) is equal to the income they earn from market employment:

$$q^f + q^m = w^m l^m + w^f l^f, \tag{4}$$

where w^m and w^f are the market wages for men and women.

The time allocation between market and non-market activities among the couple and the optimal level of private consumption can then be determined by maximizing the household's utility function based on eqs. (1) and (2) subject to constraints given by eqs. (3) and (4).

To solve the model, first define the gender wage gap (ω) as the ratio of wages of the husband and wife. Suppose ω satisfies the condition

$$\omega = \frac{w^m}{w^f} > \frac{1}{\rho}, \tag{5}$$

which implies that the husband has a comparative advantage in paid employment and his wife in housework. The first order conditions with respect to t^m and t^f then suggest that the husband allocates all his time to paid work (i.e. $t^m = 0$ and $l^m = 1$) while his wife divides her time between housework and paid employment.

Therefore, if exports affect the wages of the husband and wife such that eq. (5) continues to hold, it will not affect the husband's employment along the extensive margin

[14]Note that we ignore the notion of leisure in our simple model.

(as he will continue to work) and intensive margin (as he will continue to devote all his time to paid employment).[15] For his wife, the budget constraint in eq. (4) and the first order condition for q^f and t^f suggest that she will allocate her time between paid employment and housework according to

$$\rho\alpha\left(1-t^f+\omega\right)h' = (1-\alpha)\,h. \tag{6}$$

If an increase in exports raises the wage gap (i.e. ω), eq. (6) shows that

$$\begin{aligned}\frac{dt^f}{d\omega} &= -\frac{\rho\alpha t^f}{\rho\alpha\left(1-t^f+\omega\right)h''-\left(\rho\alpha+(1-\alpha)\right)h'} > 0\\ \frac{dl^f}{dw} &= -\frac{dt^f}{d\omega} < 0,\end{aligned}$$

which implies that she will allocate more time to housework and less time to paid employment. This leads us to the following proposition.

Proposition 1 *If the gender wage gap increases with exports, women will reduce their hours of paid market work and increase their hours of unpaid home production. Men's hours of paid work are unaffected by the variation in exports.*

Proposition 1 suggests that the gender wage gap is the channel via which exports affect women's participation in the labor force (along both intensive and extensive margins). In particular, if an increase in exports causes the gender wage gap to narrow (rise), then exports will have a positive (negative) effect on the labor force participation of women. In other words, the direction in which exports affect the labor force participation of women depends on how the gender wage gap reacts to exports. In developing countries women often tend to work in the informal sector and males in the formal sector; therefore, if export intensification raises the demand for labor in the formal exporting sector, the wages of males will increase relative to females, and exports would then be positively associated with the gender wage gap. Therefore, in developing countries, the gender wage gap is likely to rise with an increase in exports.

[15]The result that males spend all their time in paid employment is generated by the assumed pattern of comparative advantage and the substitutability of the male and female time input in the household production function. See Blundell et al (2007) for a collective household model with discrete non-participation decision.

To generate a prediction on how female labor force participation might react with an increase in exports in Indonesia, we need data on wages in order to observe the association between exports and the gender wage gap. Because the IFLS provides very limited information on wages, we conduct this study by employing the 2007 cross-sectional data from the Indonesian National Labor Survey (Sakernas, 2007). Based on this survey, we calculate the average male and female earned income at the province level,[16] and define the gender income gap as the male-to-female ratio of average earned income. In Figure 1, we plot the gender wage gap in 2007 and the log of exports in 2006 using province level data. The relationship between the two is positive with a correlation of 0.3, suggesting that in Indonesia, exports and the gender wage gap tend to vary in the same direction.

While this positive association is not to be interpreted as causal, this is the best estimate of the relationship between exports and the gender wage gap we have. If this association captures the response of the gender wage gap to exports, we may state our prediction for Indonesia based on Proposition 1 as:

Prediction 1 *In Indonesia, an increase in exports is negatively associated with women's participation in paid market work and positively associated with their participation in home production.*

4 Empirical Analysis

4.1 Data

Our dataset is assembled using three waves (1997, 2000 and 2007) of the Indonesian Family Life Survey (IFLS) panel data. The IFLS is an on-going longitudinal household survey where the first wave was conducted in 1993 (IFLS1), then in 1997/98 (IFLS2 and IFLS2+), 2000 (IFLS3) and 2007 (IFLS4). In IFLS1, 7,224 households were interviewed and detailed individual-level data were collected from over 22,000 individuals with a re-contact rate of 94.4% in IFLS2, 95.3% in IFLS3 and 93.6% in IFLS4.[17] The survey collects a wide range of information related to individuals and the households they belong to. For our work, we use all except the first wave of the IFLS as the questions on

[16] We use the question on net income earned in the last month from the main job. The data is available for 24 provinces.

[17] For the individual target households (including split-off households as separate) the re-contact rate was a little lower, 90.6% (Strauss et al., 2009).

employment in this wave has a different format from the others. In addition, we primarily use information on individuals' labor supply, gender and marital status.

Our next data source comes from the CEIC Indonesian premium database. This database provides information on the value of exports and imports (valued in Indonesian rupee and excluding oil and gas) at the province level based on documents of export-import declaration issued by the Custom and Excise Offices. Concerning exports, we do not have a further breakdown on what they are, although it is likely that our export data is dominated by manufacturing exports. For example, in 2000, the export share is 57% for manufacturing, 25% for fuel, 3.6% for agricultural raw materials. Given that our export data excludes fuel while agricultural exports are so small, our export data is likely to capture mainly manufacturing exports.

Finally, we obtain the information on cities and city population from the 2010 Population Census collected by Badan Pusat Statistik. Note that we use the 2010 data only as cities may be defined differently across years, and data on city population size may not be available for the other years during which the IFLS waves are reported. We also use ArcGIS to construct the geodesic distances between cities and the sub-district where the household is located. This information will then be used to construct our export exposure index which we will now discuss.

4.2 Key Variables

Export Exposure Index The main explanatory variable in this paper is the export exposure index that measures the exposure to export in time t, experienced by individual i living in household h that is located in sub-district d. This index, denoted by $Export\_Exposure$, is constructed in two steps. First, for each province j and each individual i, we construct the *Population Gravity Index* (PGI) to measure the individual's exposure to cities in province j, which is based on her proximity to cities in province j weighted by the size (i.e. population) of these cities. Second, we interact the individual's PGI score associated with province j by that province's exports in year $(t-1)$ to construct an export exposure index at the individual-province pair level. After which, we construct $Export\_Exposure$ by aggregating this interaction term over all provinces to obtain an aggregated measure of export exposure. The procedure is now discussed in detail below.

Step 1: Computing the Population Gravity Index

In Indonesia, manufacturing activities are primarily concentrated in places that are more urbanized than rural (see Deichmann et al. 2008).[18] Furthermore, the value of manufacturing exports is significantly larger than all other exports including the exports of fuel (the 2nd largest) and agricultural products (the 3rd largest).[19] Given that the CEIC database we use reports data on non-fuel exports, our export variable would be driven mainly by the variation in manufacturing exports. Therefore, according to Deichmann et al. (2008), the variation in our export data would have a stronger influence on individuals living in urban than in rural areas, where manufacturing is less important.

As such, we model the exposure of an individual to exports based on his or her proximity to cities (than to rural areas). To measure proximity to cities in province j, we construct the PGI score, which contains two terms: (i) the distance of a household from cities in province j and (ii) the size (i.e. population) of these cities.

The PGI score captures the idea that larger cities have greater influence or "gravity" on households than smaller cities do, although this effect will be more weakly felt by households located more deeply into the rural areas. In this regard, the PGI score of an individual is positively related to the size of cities and inversely related to the distance of that person from cities. The PGI score is also related to the idea that cities with larger populations have greater market potential. This is reminiscent of the concept of market access in the economic geography literature, such as that of Redding & Venables (2004), who define market access as the distance-weighted sum of market capacities (GDPs) of all their trade partners. The PGI score is similar in that it uses distance as a measure of access and city population (instead of GDP) as a measure of market potential.

Formally, for each province j, we construct the PGI score for an individual in household h located in sub-district d based on

$$PGI_{hdj} = \sum_{k \in K_j} \frac{p_k}{(1 + D_{dkj})^2}, \tag{7}$$

where p_k is the population of city k in province j, K_j is the total number of cities in province j, and D_{hdkj} is the geodesic distance between city k in province j to the household located in sub-district d.[20]

[18] Deichmann et al. (2008) show that manufacturing firms in Indonesia are mostly located in the peripheral areas of the Greater Jakarta and other large cities.

[19] In 2010, the share of manufacturing in Indonesia's exports was 57%, the share of fuel exports was 25%, and the share of agricultural exports was approximately 10%.

[20] Note that PGI score is computed in relation to any province, not only the province where the individual

Our data on cities and city population comes from the 2010 Population Census (Badan Pusat Statistik). When computing the PGI scores, we include every city located in each province that is reported by the Badan Pusat Statistik, where a city is defined as an area with non-agricultural economic activities that has its own local government.[21] For example, the West Java consists of Bandung, the capital city of the province, as well as large cities such as Bogor and Depok, and smaller cities such as Banjar, Bekasi, Cimah, Cirebon, Sukabumi and Tasikmalaya.

The PGI score expressed by eq. (7) is determined by two factors. First, in its numerator, we have city population, which captures the idea that cities that are larger are more influential. In its denominator, we have the distance between a household and a particular city, which captures the idea that the city's influence on the household will weaken if the household is located further away from it.

Graphically, how the PGI score is constructed can be visualized from Figures 2 and 3. Let us consider a household in Jakarta, Indonesia's capital city (Figure 2), and a household in Bima, a small city in the province of West Nusa Tenggara (Figure 3). For the Jakarta (Bima) household, we compute the geodesic distances between Jakarta (or Bima) and the other cities, where larger (smaller) cities are represented in the map by a larger (smaller) marker. Notice that Bima is more remote than Jakarta, in the sense that Bima is far away from major cities while Jakarta is a major city itself. Hence, residents in Bima will have a smaller PGI score than residents in Jakarta.

We like to make three further remarks on how the PGI score is constructed. First, for the sake of presentation, we impute city population in millions into the numerator of the PGI score. If we use the actual population instead, the coefficient on the export exposure index will be too small (i.e. have too many leading zeros in the decimal), which will be difficult to report.[22] Second, in the denominator of the PGI score, we add the value of 1 to geodesic distances. If not, division by zero becomes possible for households located within cities. Finally, the term $(1+D_{dkj})$ in the denominator is raised to the power of two to allow for the influence of cities on households to diminish more quickly as distance increases. However, it should be emphasized that the estimated effect of exports on labor

resides, hence, sub-district d does not have to be located in province j.

[21]There are a total of 95 cities in Indonesia in 2010 with Jakarta being the largest and Sabang in North Sumatra (with population of 28,454) being the smallest.

[22]If we use the actual population, the PGI score would be very large for individuals living close to large cities. As a result, the export exposure index (which is constructed using the PGI score) for these individuals will be very large and the coefficient on the index will be very small.

participation is not affected qualitatively by the choice of $(1 + D_{dkj})$ or $(1 + D_{dkj})^2$ as the denominator.[23]

Although the PGI score is not a complicated object to compute, the geodesic distances between households and cities required to compute it are somewhat difficult to obtain. This difficulty stems from the fact that the exact location of households cannot be determined from the IFLS, as the IFLS only provides the postal code of the sub-district where the household resides. Given this constraint, we measure the location of a household by the centroid of the sub-district where the household is in, and compute the geodesic distance from that household to a specific city based on the distance between the sub-district centroid (associated with the household) and the city centroid. This is done by first calculating the location of the sub-district and city centroids by their latitudes and longitudes to obtain the geodesic distance measured in degrees (i.e. in the geographic coordinates). Then, to convert these distances into kilometers, which is how D_{dkj} in the PGI score is defined, we convert the geographic coordinate system to an appropriate projected coordinate system (i.e. equidistant cylindrical projection) using the Proximity Analysis tools in ArcGIS.[24] Note that because the household's location is approximated by the sub-district centroid, households within the same sub-district will have the same PGI score. For this reason, we will drop the h subscript in eq. (7) from here onwards.

Step 2: Computing the Export Exposure Index

The household-province PGI score captures the influence that cities in a particular province (say, province j) might have on the household, where this influence will be (i) inversely related to how far away the household is from province j's cities and (ii) positively related to how large these cities are. To model the exposure of a household to province j's *exports*, we interact the volume of province j's exports with the household-province PGI score (associated with province j). The idea is that Indonesian exports are driven in large by manufacturing, which is concentrated in cities. Therefore, how strongly exposed a

[23]The estimation results with the PGI scores calculated using $(1 + D_{dkj})$ is available from the authors upon request.

[24]We use projected coordinate system because geographic coordinate system create large distortions along a number of dimensions and as we move away from the equator. Projected coordinate systems project the round surface of the earth on to a flat surface and calculate distances in meter not in degrees. However, all coordinate systems create some distortions and different projects minimize distortions along different dimensions. An equidistant cylindrical projection is a method of calculating distance in projected coordinated system. The reason behind choosing the equidistant cylindrical method is that it has minimal distortion along the distance dimension and hence is useful for calculating distances.

household is to province j's exports depends on how strongly influenced the household is by province j's cities.

To construct our (aggregated) export exposure index, we aggregate this interaction term over all provinces (indexed by j):

$$\begin{aligned} Export\_Exposure_{dt} &= \sum_{j \in J} \left(\sum_{k \in K_j} \frac{p_k}{(1 + D_{dkj})^2} \ln(Export_{jt-1}) \right) \\ &= \sum_{j \in J} PGI_{dj} \ln(Export_{jt-1}). \end{aligned} \tag{8}$$

It should be pointed out that the effect of the export exposure index *per se* is not of interest here. Instead, the export exposure index is a device for us to estimate the effect that exports might have on individuals. Because the export exposure index contains both cross-sectional and time variation, it allows us to use an appropriate fixed effects strategy to deal with certain confounding issues, which are discussed further in Section 4.4.

Labor Force Participation We use several variables to measure an individual's employment at the extensive or intensive margin. In the baseline case, the extensive margin of work is related to whether that person is engaged in work (paid or unpaid), or does not work. To capture this information, we construct a binary variable *Work*, which is equal to 1 if the individual reports work and 0 if otherwise. As dependent variables in our regressions, we also consider the extensive margin of paid employment (vesus non-paid or no work) as well as the extensive margin of work (paid or unpaid) in the agriculture, manufacturing or services sector, where pertaining to each sector, we construct a binary variable to indicate if an individual reports employment in that sector and zero if otherwise. Finally, we also use information on the reported types of work, such as an individual being a government worker, being self-employed, being engaged in housework, etc., and create a binary variable for each reported types of work.

Besides the extensive margin, we consider an individual's labor force participation at the intensive margin. To do so, we construct two dependent variables. The first is *Hours_Usual*, which is equal to reported hours of any work that an individual normally does. The second is *Hours_Last_Week*, which is equal to reported hours of any work performed in the previous week. We consider both measures of the hours of work to ensure that our results are not influenced by variable definitions.

Control Variables We consider the following control variables in our regressions. The first control variable is an import exposure index to capture the effect of imports on labor force participation. This is relevant in light of Amiti and Davis (2011) and Amiti and Cameron (2012) who have shown that imports may affect wages. For instance, Amiti and Davis (2011) find that in Indonesia, a fall in input tariffs may increase wages in import-using firms relative to wages in firms that buy their inputs domestically. Amiti and Cameron (2012) also find that in Indonesia, the production of intermediate inputs tends to be more skilled-intensive than production of final goods; therefore, a reduction in input tariffs can reduce the skill premium. Given that imports could affect labor force participation through their effects on wages, it is important that we control for information about imports in our regression. To this end, we construct an import exposure index in the same way as we did for the export exposure index as follows:

$$
\begin{aligned}
Import\_Exposure_{dt} &= \sum_{j \in J} \left(\sum_{k \in K_j} \frac{p_k}{(1 + D_{dkj})^2} \ln(Import_{jt-1}) \right) \\
&= \sum_{j \in J} PGI_{dj} \ln(Import_{jt-1}).
\end{aligned} \tag{9}
$$

We use $Import\_Exposure$ as opposed to import volume as a control variable, for the same reason that $Import\_Exposure$ will not be "cleaned out" from a regression with household and province-year fixed effects.

The second control variable is the individual's age. This is motivated by Jensen (2012) who finds that younger women are significantly less likely to get married, have fewer children, and more likely to work. In other words, older women are more likely to engage in unpaid home production than in market work, in which case, age is likely to be correlated with labor force participation. To allow for the relationship between work and age to have a nonlinear profile, we include age squared as a control variable as well.

Summary Statistics Table 1 provides a list of the main variables of this paper. Our empirical analysis is based on a panel of married males and females aged from 20 to 65 years for the years 1997, 2000 and 2007. We exclude those who are younger than 20 years old as they might still be in school. Our base sample contains 13,149 individual-year observations for married females and 16,745 individual-year observations for married males. The summary statistics of the main variables are reported in Table 2. Compared to males, females on average are less likely to report as being employed. Moreover, for those who are employed, females also work fewer hours than males on average. Across sectors, working females are more likely to be employed in the services sector than in the agricultural and manufacturing sectors. Compared with males, females are also less likely to be self-employed, or be a government or salaried employee, although they are more likely to be involved in housework or unpaid family work.

4.3 The Estimating Equation

Our main estimating equation relates an individual's decision to work (at the extensive or intensive margin) to the export exposure index ($Export\_Exposure$),

$$W_{ihdjt} = \mu_h + \alpha_{jt} + \beta \ Export\_Exposure_{dt} + \gamma' C_{ihdjt} + \epsilon_{ihdjt}. \tag{10}$$

where W (subscript suppressed) is a generic representation of work that represents either the extensive margin of work (*Work*) and the intensive margin of work (*Hours_Usual* or *Hours_Last_Week*). Eq. (10) also includes a vector of individual level controls denoted by C. This vector consists of the import exposure index (see eq. (9)), the age and the squared of age of the individual. Finally, the model also includes household fixed effects represented by μ_h and province-year fixed effects represented by α_{jt}.

Our main objective is to estimate the parameter β in eq. (10), which is the coefficient on the export exposure index. Although β summarizes the effect that export exposure might have one's decision to work, we can only interpret its sign but not its size. This is because the size of β depends on the chosen unit of measurement for city population for the PGI score. If we use city population in millions to construct the PGI score, $Export\_Exposure$ will be smaller, and thus, β would be larger. Conversely, if we use the actual population instead, β will be smaller. As discussed, we construct the PGI score using city population in millions so that the estimate of β will have fewer leading zeros in its decimal, which makes presenting it easier in tables.

The sign of β can be interpreted in a meaningful way as it conveys information about whether export intensification itself (not just export exposure) has a positive or negative effect on a particular measure of work. For example, based on eq. (8), we can calculate the effect of a 1% increase in exports across all provinces on work as

$$\frac{\beta}{100} * \sum_{j \in J} PGI_{dj}. \tag{11}$$

Because the PGI score is positive, whether exports affect work positively or negatively depends on the sign of β; if β is positive, both export exposure and exports will have a positive effect on work on average.

From eq. (11), notice that the effect of exports on work is heterogeneous across households. In particular, the effect will be weak for households that are far from all cities, which will be reflected by a small aggregated PGI score ($\sum_{j \in J} PGI_{dj}$). By contrast, the effect will be strong for households located in a large city that is part of a metropolis as well (e.g. Jakarta). The heterogeneity in the effect of exports, which is shown in eq. (11), allows us to use appropriate fixed effects to address certain estimation issues that are discussed below.

4.4 Estimation Issues

Let us discuss some common estimation issues that could be relevant to this study.

Reverse Causality One common estimation issue is reverse causality. For it to be a concern in the context of our model (see eq. 10), an individual's decision to work has to have influence on *Export_Exposure*. However, this is unlikely as the time series variation of *Export_Exposure* comes from provincial level exports, which are unlikely to be influenced by an individual.

Self-Selection While the time series variation of *Export_Exposure* is driven by the provinces' exports, the cross-sectional variation of this index depends on the location of the household. Therefore, households that have better attributes for market work may choose to live closer to metropolitan areas. In this case, the geodesic distances that are used to compute *Export_Exposure* could be influenced by self-selection. To address this issue, we use household fixed effects (μ_h). To the extent that the locational choice of a household is related to persistent, unobserved household characteristics, the issue of self-selected location may be addressed by using household fixed effects to partial out these unobserved household factors.

Unobserved Macroeconomic and Policy Shocks The link between exports and the work decisions of individuals can be confounded by macroeconomic and policy shocks. These factors may include business cycle shocks that affect provinces differently, as well as province specific unemployment rate and GDP growth that affect the tightness of regional labor markets. Other confounding factors may also include persistent factors such as institutions or cultural norms at the province level, which could be correlated with whether women are more likely to work. To eliminate these confounders, we include province-year fixed effects (α_{jt}) to capture all factors – observed or unobserved, time-varying or time invariant – at the province and national levels.

Measurement Error Our main explanatory variable, *Export_Exposure*, is constructed using the individual's location at the sub-district level and the value of exports at the province level. While the individual's location is unlikely to be misreported because there is cross-verification,[25] provincial export volumes could contain measurement error. If this error was classical, the estimated effect of *Export_Exposure* would be attenuated. Another possible measurement issue arises with respect to the *Work* variable. If women are reluctant to report truthfully about whether they are employed, for example, if they tend to report not being employed, their self-reported work status would be less responsive to *Export_Exposure* than what is true in reality.

Unfortunately, panel data regression cannot address the issue of measurement error. Nonetheless, if the measurement error in question leads to attenuation bias (which Section 5 offers some evidence for), our regression estimates would still be informative in that the actual effect of *Export_Exposure* (if it exists) is likely to be stronger than what the estimates suggest.

Other Issues In Indonesia, the labor force participation rate in rural areas, because of agriculture, can be higher than that in urban areas for both males and females (Agrawal, 1996; Cameron, 2002). However, this will not confound the effect that the export exposure index has on labor force participation as the household fixed effect will take care of all time-invariant heterogeneity across households including the locational characteristics where the households live in. Therefore, concerns that some individuals are living in places with higher female labor force participation rates will be taken care of household

[25]The information about the location was cross checked by the surveyor with the answer of household (Source: IFLS user guide).

fixed effects.

The effect of exports on labor force participation in eq. (5) can be interpreted as a treatment effect where individuals in large cities are in the treatment group and others in the control group. Intuitively, a person in a large city such as Jakarta will have a large PGI score, which means that the influence of exports on him or her could be large. Conversely, a person in a small city or in a rural area will have a very small PGI score, so that exports will have a negligible effect. Therefore, we may interpret the variation of exports as a treatment, individuals in large urban areas as the treatment group, and those in small cities or rural areas as the control group. In this case, the estimated effect of exports in eq. (5) may only be local to individuals in large cities, which means that it is not necessarily externally valid for residents in small cities and rural areas.

5 Results

We estimate eq. (10) separately for men and women. Other than Table 3, we report our results for women in the "A" affixed tables (e.g. Tables 4A, 5A, etc.) and men in the "B" affixed tables (e.g. Tables 4B, 5B, etc.). Standard errors have been adjusted for clusters at the household level. All our regressions control for age, the squared of age, household and province-year fixed effects.

5.1 The Extensive Margin of Work

We first examine the relationship between *Export_Exposure* and the extensive margin of work. The latter is represented by the binary variable *Work*, which is equal to one if the individual reports having worked in the past week. For now, work could refer to either paid or unpaid work such as work on a family farm. Later on, we will also consider the response of different types work (e.g. paid, unpaid, etc.) to exports. As *Work* is a binary dependent variable, the coefficient on *Export_Exposure* captures its effect on the *probability* that an individual is engaged in some form of work.

In Column (1) of Table 3, the coefficient of -0.233 on *Export_Exposure* suggests that women are less likely to work when they are more exposed to exports. Although the size of this coefficient has no meaningful interpretation, the coefficient itself can be used to calculate the effect of a 1% increase in exports across all provinces on the extensive margin of work. Following eq. (11), this effect (for women) is given by

$$-\frac{.233}{100} * \sum_{j \in J} PGI_{dj} \equiv -\frac{0.233}{100} * \sum_{j \in J} \sum_{k \in K_j} \frac{p_k}{(1 + D_{dkj})^2}. \quad (12)$$

According to eq. (12), the effect of exports on *Work* is heterogeneous across locations such that the effect is stronger for women living near or within metropolitan areas and weaker if otherwise. For example, women in Jakarta have an aggregate PGI score (i.e. $\sum_{j \in J} PGI_{dj}$) of 11.235. Therefore, eq. (12) suggests that they are 2.61 percentage points less likely to work when exports increase by 1% across all provinces.[26] By contrast, for women in Bima, a 1% increase in exports across all province has a negligible effect on the probability that they work.

For men, *Export_Exposure* is not statistically significant (Column (2)), which suggests that their labor supply is inelastic with respect to exports. These results are consistent with our model prediction in Section 3, where we studied a simple household model in which men have comparative advantage in paid market work and women in unpaid housework. In this model, men's labor supply is inelastic as they devote all their time to market work. Moreover, if the increase in exports increases the relative wage of men in a way that preserves their comparative advantage in market work, then their labor supply would be unaffected, while women would cut down on paid employment and devote more to unpaid housework, which is consistent with the regression results here.

Next, we examine the effect of *Export_Exposure* on the extensive margin of *paid employment*. Here, we construct two dependent binary variables: *Own_Income* $(= 1)$ if the person reports having earned an income from work and *Spouse_Income* $(= 1)$ if the same person reports that his or her spouse has earned an income from work. Therefore, the men in our sample will report *Own_Income* about themselves and *Spouse_Income* about their wives. Likewise, the women in our sample will report *Own_Income* about themselves and *Spouse_Income* about their husbands.

In this way, a person's participation in paid employment (if any) will be reported twice. For example, for a male person, his paid employment status is recorded once when he reports *Own_Income* and again when his wife reports *Spouse_Income* about him. Hence, in the absence of any reporting discrepancy between couples, the information in *Own_Income* reported by men (women) should be the same as *Spouse_Income* reported

[26] To calculate this, we replace $\sum_{j \in J} PGI_{dj}$ with 11.235 in eq. (12) to obtain $-0.233/100 * 11.235 = 0.0261$, which is 2.61 percentage points.

by their wives (husbands).

For men, both Tables 4A and 4B show that exports do not have statistically significant effect on their participation in paid employment. For example, using the paid employment status of men reported by their wives as the dependent variable, we find that *Export_Exposure* has no statistically significant effect on it (Column (2) of Table 4A). We also observe the same when we consider men's self-reported status of paid employment as the dependent variable (Column (1) of Table 4B).

By contrast, using the paid employment status of women reported by their husbands as the dependent variable, we find that women are less likely to work for pay when exports increase (Column (2) of Table 4B). Moreover, the coefficient on *Export_Exposure* in this case is -0.623, which is nearly three times the estimate of -0.233 from the baseline regression (see Table 3), where work is defined as paid market work and unpaid work for the family. In other words, when we consider paid employment only, we find that exports has an even stronger negative effect on women's work participation. This suggests that the effect of exports on paid employment is much stronger than that on unpaid work.

As we have information on one's participation in paid employment that is reported by both self and spouse, we may use it to investigate whether measurement error in self-reported work status is present and its implication. For example, if women are reluctant to report truthfully about whether they work, then what they report about themselves could be less accurate than what their husbands report about them. In particular, if they are inclined to report that they did not work regardless of their personal circumstance, then their self-reported employment status would be less sensitive to variations in exports than their actual employment status would be. Hence, the estimated relationship between *Export_Exposure* on women's participation in paid employment would be weaker if the latter is constructed based on women's self-reported information than what is reported by their husbands.

Tables 4A and 4B offer some evidence that such measurement errors in women's self-reported data are present. For example, the coefficient on *Export_Exposure* when the dependent variable is based on women's self-reported paid employment status (Column (1) of Table 4A) is only a tenth of the effect when the dependent variable is based on their work status reported by their husbands (Column (2) of Table 4B). This example suggests that when the dependent variable is constructed with women's self-reported information (as in the baseline regression), the actual effect of exports on women's labor participation could be understated. In this case, our results about women, based mainly on their self-reported information, would bound the true effect of exports on their labor force participation from below.

As a robustness check, we conduct a falsification exercise to examine if the negative association between exports and women's labor participation is causal and not merely a correlation. To do so, we estimate the effect of *Export_Exposure* on the lag of *Work*.[27] The idea is that a forward variable cannot cause variables in the past; therefore, *Export_Exposure* cannot affect the lag of *Work*.

Nonetheless, the "effect" of *Export_Exposure* on the lag of *Work* could still be statistically significant for two reasons. First, it could be due to *Work* reverse causing *Export_Exposure*, which we do not believe to be the case for reasons outlined in Section 4.4. Second, it could be due to unknown factors driving *Export_Exposure* and the lag of *Work* jointly. These factors could themselves generate co-movements between *Export_Exposure* and (contemporaneous) *Work*; in which case, the observed effect of exports on women's participation (e.g. Table 3) is not necessarily causal.

To establish otherwise, we look at whether the relationship between *Export_Exposure* and the lag of *Work* (for women) is statistically *insignificant*. In our regressions (omitted here to save space), we find that there is no statistically significant relationship between *Export_Exposure* and the lag of *Work*. This suggest that there are no variables important enough to drive *Export_Exposure* and the lag of *Work* jointly, which we worry could drive *Export_Exposure* and (contemporaneous) *Work* jointly as well. Therefore, by finding no evidence that such omitted variables are present, we have some support that the estimated effect of exports on women's labor participation reported here is causal and not only a correlation driven by some unknown factors.

By Sector The IFLS provides information on the sector that an individual work is employed in. We examine the relationship between exports and participation in three sectors – agriculture, manufacturing and services. To do so, we construct a binary dependent variable that indicates if an individual reports work (paid or unpaid) associated with each sector. Manufacturing is the largest exporting sector in Indonesia: in 2010, the value share of manufactures in total exports was 57%. Agriculture, with the share of 10% in 2010, is the next largest exporting sector under consideration. By contrast, services in

[27]The IFLS surveys contain information on work status in the previous years. However, they do not provide information on hours of work in the previous years. Hence, we are able to conduct such falsification test only for the binary variable *Work*.

Indonesia are mostly non-traded. In our sample, 32% of all women and 35% of all men report working in agriculture, 16% of women and 13% of men report in manufacturing, and 50% of women and 36 % of men in the services.

For women, Table 5A shows that an increase in exports reduces the probability of work in the agricultural sector on average. With a coefficient of -0.096 on *Export_Exposure* (statistically significant at 1% level), a woman with an average aggregated PGI score would be 0.0029 percentage points less likely to work in the agricultural sector (compared with 1.07 percentage points for women in Jakarta) when exports across all provinces increase by 1%. However, this effect of exports on women's employment in the agricultural sector is weaker than that in the manufacturing sector. With a coefficient of -0.121 on *Export_Exposure*, a woman with an average aggregated PGI score would be 0.0037 percentage points less likely to work in the manufacturing sector (compared with 1.36 percentage points for women in Jakarta) when exports across all provinces increase by 1% .[28] With respect to the services sector, we find that exports do not have a statistically significant effect on women's participation. Therefore, the negative relationship between exports and women's participation is driven mainly by attrition from the agricultural and manufacturing sectors.

For men, we look at their labor force participation in the agricultural, manufacturing, services and construction sectors. The construction sector is the forth largest sector of male employment, where nearly 8% of all men in our sample are employed. Just as in our baseline regressions, we find no evidence that exports affect men's participation in each of the four sectors, which reinforces the idea that their labor supply is inelastic with respect to exports.

By Types of Work Here, we examine the effect of exports on participation in different (non-mutually exclusive) types of work: self-employment, housework (i.e. housekeeping), employment with the government, salaried work, or unpaid family work. Column (1) of Tables 6A and 6B show that exports are statistically insignificant for self-employed work for both men and women. For women, given that the majority of self-employed are in the services sector,[29] this is consistent with the previous observation that exports do not

[28]The average aggregated PGI score for women is 0.0308474. For agriculture, the calculation is based on $(-0.096/100) * 0.0308474 = -0.000029$. For manufacturing, it is $(-.121/100) * 0.0308474 = -0.000037$. To obtain the estimates for residents in Jakarta, we can use their aggregated PGI score of 11.235.

[29]According to Table 2, 42% of females and 50% of males in our sample report being self-employed. However, for self-employed females, 20% of them work in agriculture, 13% in manufacturing and 67% in

have a statistically significant effect on women's participation in the services (Table 5A). For men, it is consistent with the fact that exports generally do not have a statistically significant effect on men's participation in the labor force (Table 5B).

With respect to participation in housework, Column (2) of Tables 6A and 6B suggests that an increase in exports would lead to more household work by women on average but not by men. This result is also mirrored by Column (3) of Tables 6A and 6B, where an increase in exports reduces the participation of women in paid employment on average. As a remark, we have also looked at the effect of exports on the extensive margin of paid employment in the agricultural, manufacturing and services sector. For each of these sectors, we find that the effect of exports is negative and statistically significant (at 5%) for women but is statistically insignificant for men.[30] These observations are consistent with exports having a negative effect on women's participation in paid employment (Tables 4A and 4B) as well as employment in general across sectors (Table 5A).

Finally, for both men and women, Column (4) of Tables 6A and 6B show that participation in government related work is largely unaffected by exports, which seems sensible as government sector jobs are usually more insulated from macroeconomic shocks. In Column (5), we also find that the effect of exports on unpaid family work is statistically insignificant for either gender. For women, this result could be driven by the fact that a large proportion of those in unpaid family work (i.e. 22%) are in the services sector, whose decision to participate in the labor force is generally unresponsive to variations in exports on average (see Table 5A).

In sum, recall that our baseline regression considers work to encompass paid market work and unpaid family work. Since the relationship between exports and unpaid family work is statistically insignificant, this suggests that the negative effect of exports on women's participation reported in our baseline regression (see Table 3) is driven mainly by the reduction in paid work (and not unpaid family work) at the extensive margin.

By Previous Year Work Status In this section, we take another look at the relationship between exports and the decision to start or stop working. Here, we consider a sample of individuals who have not worked (or have worked) in the year prior to the IFLS census year and investigate whether an increase in exports could encourage a person who has

services. By contrast, for self-employed males, 52% of them work in agriculture, 6% in manufacturing, 31% in the services and 3% in construction.

[30]The estimation results are not reported here and available upon request.

worked (not worked) in the previous year to exit (enter) the labor force. Decisions concerning work are usually persistent across time. Among women who worked during the IFLS census year, 93% of them had worked in the previous year; among women who did not work during the IFLS census year, 58% of them did not work in the previous year. Similarly, for men, 98% of those who worked during the IFLS census year had worked in the previous year while 63% of those who did not work during the IFLS census year did not work in the previous year as well.

For women who did not work in the year prior to the IFLS census, Table 7A shows that exports do not have a statistically significant effect on encouraging them to enter the labor force in the census year. In other words, women who did not work in the year prior to the IFLS census largely remained the same even if exports increase. However, for those who had worked in the year prior to the IFLS census, an increase in exports has a negative effect on their labor force participation. This suggests that an increase in exports encourages women who were employed to exit the labor market.

For men who did not work in the year prior to the IFLS census, an increase in exports increases the probability that they work during the census year. However, for those who had worked in the year prior to the IFLS census, exports do not have a statistically significant effect in encouraging them to leave the labor force. This implies that men would try to gain employment (if they were unemployed) and stay employed regardless of how exports vary.

5.2 Intensive Margin of Work

Finally, we examine the effect that an increase in exports might have on the intensive margin of work, which is captured by the hours of work performed by those who are employed. We estimate the effect of *Export_Exposure* on *Hours_Last_Week* (see Tables 8A and 8B) or *Hours_Usual* (see Tables 9A and 9B), where recall that *Hours_Last_Week* is the reported hours of any work performed in the previous week, and *Hours_Usual* is the reported hours of any work that an individual normally does.

We first examine the relationship between exports and the intensive margin of work by types of work. Here, we find that an increase in exports has a negative and statistically significant effect on women's hours of salaried work (based on either *Hours_Last_Week* and *Hours_Usual* as the measure of the intensive margin of work). Therefore, exports may reduce participation in salaried work by women along the intensive margin, as well as along the extensive margin as was reported in Table 6A. In addition, for women, we find that an increase in exports increases their hours of unpaid family work and hours of housework. Therefore, an increase in exports encourages women to substitute their time away from paid market work towards unpaid non-market work. For men, we also find that a reduction in the hours of paid employment on average when exports increase. A possible explanation, although one we cannot verify, is that an increase in exports has an effect of raising the wages for men to a point where the income effect dominates.

Next, we look at the relationship between exports and the intensive margin of work by sector. In this exercise, there is little to take away as our estimated coefficient on *Export_Exposure* is mainly statistically insignificant. For women, we find a negative association between exports and their hours of work in the services, although we have previously observed that export exposure is not statistically significant for their participation in the services sector at the extensive margin. For men, an increase in exports is associated with less work in agriculture and more work in construction and manufacturing. However, these interpretations should be viewed with caution as our results here are generally statistically insignificant.

6 Conclusion

Over the past fifteen years, there has been a growing interest on the effect that exports might have on the participation of females in the labor force. Although the existing evidence suggests that an increase in exports has a positive effect on the female labor force participation rate, much of this literature is based on cross-sectional studies that lack a causal interpretation or empirical analyses that overlook the role of women at home. Our contribution in this paper is to use rigorous panel data regression analysis with the IFLS data to revisit this issue based on Indonesia as an example. To deal with estimation issues arising primarily from omitted households characteristics and macroeconomics and policy shocks, we construct a new measure – the exports exposure index – that captures the differentiated influence of exports on individuals depending on how close individuals are to cities. As the export exposure index has both cross-sectional and time variation, it allows us to use household and province-year fixed effects to purge all household characteristics and macroeconomic shocks at the province or national level, which has not been done in the literature.

Our empirical results show that exports have gender specific effects on labor force participation. In particular, we find that an increase in exports encourages women to allocate time away from paid employment towards unpaid house or family work at both the extensive and intensive margins; but there is no statistically significant effect of exports pertaining to men on average. This observation is consistent with the theoretical prediction of the simple collective household model considered here, where the intuition is that the relative increase in spousal income (following an increase in exports) strengthens the comparative advantage of females in unpaid housework and encourages them to devote more time to home production. Finally, Brown and Park (2002) argue that women can be better empowered if they participate in the labor force. However, unlike what the existing literature has mainly found, our paper shows that export orientation may not necessarily lead to greater participation of females in the labor force, and therefore, greater female empowerment through this channel.

Table 1: List of variables

Paid/Unpaid Work (Extensive Margin)	
Work	= 1 if the individual reports that working was a primary activity (at least one hour) during the past week
Self Work	= 1 if the individual is self-employed in his/her primary job
Housework	= 1 if the individual reports that housekeeping as a primary activity during the past week
Government Work	= 1 if the individual is a government worker in his/her primary job
Salaried Work	= 1 if the individual is a salaried employee in his/her primary job
Unpaid Family Work	= 1 if the individual reports working for family without pay in his/her primary job
Own_Income	= 1 if an individual reports earning his or her own income
Spouse_Income	= 1 if an individual reports that his or her spouse earns her or his own income.
Hours of Paid Work (Intensive Margin)	
Hours_Usual	hours of work per week that the individual usually does
Hours_Last_Week	total number of hours of work that the individual did in the last week

Table 2: Summary statistics

	(1) Females		(2) Males	
	Mean	sd	Mean	sd
Age	40.964	11.247	41.531	10.983
Work	0.8609	0.3459	0.9844	0.1236
Work (in agriculture)	0.3515	0.4774	0.3669	0.4819
Work (in manufacturing)	0.1429	0.3500	0.1184	0.3231
Work (in services)	0.4867	0.4998	0.3444	0.4752
Work (in construction)	0.0076	0.0868	0.0779	0.2680
Housework	0.1942	0.3956	0.0126	0.1115
Self-employed Work	0.4182	0.4932	0.5005	0.5000
Government Work	0.0704	0.2558	0.1022	0.3029
Salaried Work	0.2203	0.4145	0.3324	0.4711
Unpaid Family Work	0.2597	0.4384	0.0236	0.1519
Hours_Usual	37.586	21.03	43.829	17.471
Hours_Last_Week	33.748	22.885	39.779	20.194
Export_Exposure	0.2852	2.1592	0.3281	2.7260
Import_Exposure	0.2761	2.1016	0.3175	2.6601
PGI	0.0308	0.2025	0.0348	0.2560
Obsevations	13149		16745	

Table 3: Probability of work (Females and Males)

	(1) Females	(2) Males
Dependent Variable:	*Work*	
Export Exposure	-0.2329***	0.0223
	(0.093)	(0.117)
Import Exposure	0.2260**	-0.0227
	(0.091)	(0.131)
Age	0.0496***	0.0301***
	(0.002)	(0.002)
Age Squared	-0.0006***	-0.0004***
	(0.000)	(0.000)
Constant	-1.079***	0.417***
	(0.077)	(0.059)
Observations	23,150	18,408
R-squared	0.049	0.055
Number of households	9,492	8,424
Household FE	Yes	Yes
Year*Province FE	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4A: Probability of earning own income and husband earning own income (reported by females)

	(1)	(2)
DEPENDENT VARIABLE:	*Own_Income*	*Spouse_Income (Husband)*
Export Exposure	-0.0636	-0.0574
	(0.195)	(0.125)
Import Exposure	0.0897	0.1579
	(0.295)	(0.223)
Age	0.0487***	0.0211***
	(0.005)	(0.004)
Age Squared	-0.0006***	-0.0003***
	(0.000)	(0.000)
Constant	-0.5098***	0.5839***
	(0.117)	(0.083)
Observations	12,501	12,500
R-squared	0.032	0.044
Number of Households	6,881	6,881
Household FE	Yes	Yes
Year*Province FE	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4B: Probability of earning own income and wife earning own income (reported by males)

	(1)	(2)
DEPENDENT VARIABLE:	*Own_Income*	*Spouse_Income (Wife)*
Export Exposure	0.1196	-0.6234**
	(0.121)	(0.259)
Import Exposure	-0.1517	0.8351**
	(0.228)	(0.388)
Age	0.0242***	0.0258***
	(0.004)	(0.006)
Age Squared	-0.0003***	-0.0002***
	(0.000)	(0.000)
Constant	0.5098***	-0.2341
	(0.099)	(0.193)
Observations	11,242	11,234
R-squared	0.032	0.036
Number of Households	6,454	6,453
Household FE	Yes	Yes
Year*Province FE	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5A: Probability of work by sector (Females)

	(1)	(2)	(3)
	Agriculture	Manufacturing	Services
DEPENDENT VARIABLE:		*Work*	
Export Exposure	-0.0960***	-0.1211***	-0.0776
	(0.026)	(0.045)	(0.084)
Import Exposure	0.0801***	0.1167***	0.1046
	(0.030)	(0.043)	(0.083)
Age	0.0171***	0.0023	0.0337***
	(0.002)	(0.002)	(0.002)
Age Squared	-0.0002***	-0000***	-0.0000***
	(0.000)	(0.000)	(0.000)
Constant	-0.1453**	0.1099***	-0.8550***
	(0.072)	(0.037)	(0.087)
Observations	23,150	23,150	23,150
R-squared	0.046	0.014	0.036
Number of Households	9,492	9,492	9,492
Household FE	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5B: Probability of work by sector (Males)

	(1)	(2)	(3)	(4)
	Agriculture	Manufacturing	Services	Construction
DEPENDENT VARIABLE:	*Work*			
Export Exposure	0.0284	0.0048	0.0209	0.0697*
	(0.031)	(0.053)	(0.073)	(0.039)
Import Exposure	-0.0322	-0.0210	-0.0024	-0.0889*
	(0.032)	(0.059)	(0.078)	(0.048)
Age	0.0025	-0.0021	0.0189***	0.0051***
	(0.002)	(0.002)	(0.003)	(0.001)
Age Squared	0.0000	-0.0000	-0.0002***	-0000***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.1892**	0.2671***	0.1184	-0.0339
	(0.084)	(0.065)	(0.091)	(0.040)
Observations	18,408	18,408	18,408	18,408
R-squared	0.026	0.021	0.013	0.010
Number of Households	8,424	8,424	8,424	8,424
Household FE	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6A: Probability of work by types of work (Females)

	(1)	(2)	(3)	(4)	(5)
	Types of Work				
DEPENDENT VARIABLE:	*Self Work*	*Housework*	*Government Work*	*Salaried Work*	*Unpaid Family Work*
Export Exposure	-0.0842	0.1782*	0.0320	-0.2149***	-0.0385
	(0.076)	(0.094)	(0.023)	(0.064)	(0.076)
Import Exposure	0.0898	-0.1658*	-0.0303	0.2140***	0.0417
	(0.077)	(0.089)	(0.024)	(0.062)	(0.084)
Age	0.0328***	-0.0299***	0.0058***	0.0056***	0.0068***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Age Squared	-0.0003***	0.0002***	-0.0000***	-0.0001***	-.0000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.4564***	1.7699***	-0.0398	-0.3776***	0.1897**
	(0.060)	(0.078)	(0.095)	(0.054)	(0.090)
Observations	23,150	23,150	23,150	23,150	23,150
R-squared	0.036	0.035	0.017	0.031	0.030
Number of Households	9,492	9,492	9,492	9,492	9,492
Household FE	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6B: Probability of work by types of work (Males)

	(1)	(2)	(3)	(4)	(5)
	Types of Work				
DEPENDENT VARIABLE:	*Self Work*	*Housework*	*Government Work*	*Salaried Work*	*Unpaid Family Work*
Export Exposure	0.0023	0.0115	0.0010	0.0432	-0.0226
	(0.062)	(0.012)	(0.034)	(0.068)	(0.023)
Import Exposure	-0.015	-0.0096	-0.0107	-0.0469	0.0212
	(0.065)	(0.013)	(0.038)	(0.075)	(0.023)
Age	0.0186***	-0.0024*	0.0203***	-0.0099***	-0.0086***
	(0.003)	(0.001)	(0.002)	(0.003)	(0.001)
Age Squared	-0.0001***	0.0000**	-0.0002***	0.0000	0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.2021***	0.0274	-0.3152***	0.8003***	0.2751***
	(0.074)	(0.033)	(0.035)	(0.082)	(0.075)
Observations	18,408	18,408	18,408	18,408	18,408
R-squared	0.037	0.019	0.034	0.098	0.022
Number of Households	8,424	8,424	8,424	8,424	8,424
Household FE	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7A: Probability of work conditional on previous year work status (Females)

	(1)	(2)
Worked in the previous year?	No	Yes
DEPENDENT VARIABLE:	*Work*	
Export Exposure	0.4684	-0.2630**
	(1.225)	(0.107)
Import Exposure	-0.6665	0.2894***
	(1.297)	(0.102)
Age	0.0343*	0.0301***
	(0.018)	(0.004)
Age Squared	-0.0004**	-0.0003***
	(0.000)	(0.000)
Constant	-0.3623	-0.5752***
	(0.369)	(0.089)
Observations	2,426	13,432
R-squared	0.120	0.049
Number of Households	2,166	6,903
Household FE	Yes	Yes
Year*Province FE	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7B: Probability of work conditional on previous year work status (Males)

	(1)	(2)
Worked in the previous year?	No	Yes
DEPENDENT VARIABLE:	*Work*	
Export Exposure	1.8868***	-0.0602
	(0.653)	(0.103)
Import Exposure	-2.4551**	0.0519
	(1.242)	(0.116)
Age	0.0790	0.0099***
	(0.058)	(0.002)
Age Squared	-0.0009	-0.0001***
	(0.000)	(0.000)
Constant	-0.5898	0.8070***
	(1.139)	(0.046)
Observations	659	17,121
R-squared	0.567	0.014
Number of Households	616	8,101
Household FE	Yes	Yes
Year*Province FE	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8A: Hours of work in the previous week (Females)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Types of Work			
DEPENDENT VARIABLE:	*any work*	*salary work*	*housework*	*self work*	*unpaid family work*	*agriculture*	*manufacturing*	*service*
Export Exposure	-18.52*	-35.42*	74.91	-27.45	80.10***	246.15	12.48	-27.00**
	(9.45)	(20.52)	(161.09)	(19.26)	(15.40)	(181.19)	(21.51)	(10.63)
Import Exposure	19.09*	33.09*	-73.43	32.22	-73.90***	-168.32	-19.82	26.70**
	(9.23)	(18.82)	(146.15)	(19.98)	(15.98)	(197.32)	(23.07)	(10.39)
Age	0.6017***	-0.2154	-0.0263	0.8175*	0.4141	0.8506***	-0.3823	1.029***
	(0.221)	(0.509)	(0.620)	(0.457)	(0.440)	(0.286)	(0.650)	(0.364)
Age squared	-0.0076***	-0.0002	-0.0007	-0.0090*	-0.0056	-0.0097***	0.0052	-0.0109**
	(0.002)	(0.006)	(0.007)	(0.005)	(0.005)	(0.003)	(0.007)	(0.004)
Constant	24.71***	47.12***	21.71	18.13*	24.06**	8.64	42.36***	7.947
	(4.63)	(10.40)	(16.15)	(10.41)	(9.54)	(6.33)	(13.15)	(7.59)
Observations	11,355	2,904	2,576	5,531	3,422	4,630	1,886	6,433
R-squared	0.018	0.059	0.159	0.018	0.104	0.104	0.063	0.022
Number of Households	6,216	2,085	2,242	3,544	2,350	2,743	1,388	3,923
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8B: Hours of work in the previous week (Males)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Types of Work							
DEPENDENT VARIABLE:	*any work*	*salaried work*	*housework*	*self work*	*construction*	*agriculture*	*manufacturing*	*service*
Export Exposure	-3.044	-12.50*	6.051e+10	-7.968	0.225	-3.923	-2.673	-12.73*
	(4.417)	(7.070)	(1.617e+07)	(19.74)	(17.22)	(87.18)	(8.870)	(7.002)
Import Exposure	3.590	13.11*	-5.283e+06	10.42	7.110	14.48	2.505	13.28**
	(4.824)	(7.008)	(1.384e+07)	(19.86)	(16.16)	(81.75)	(11.07))	(6.919)
Age	0.536***	0.612	0.193	0.787***	-0.352	0.742**	0.0247	0.776*
	(0.168)	(0.385)	(3.409)	(0.264)	(0.715)	(0.288)	(0.625)	(0.399)
Age Squared	-0.008***	-0.009**	0.010	-0.011***	0.002	-0.009***	-0.002	-0.008*
	(0.001)	(0.004)	(.0462)	(0.003)	(0.008)	(0.003)	(0.007)	(0.004)
Constant	34.50***	34.46***	-93440	28.97***	49.44***	20.21***	46.27***	25.38***
	(3.574)	(7.620)		(5.801)	(14.85)	(6.279)	(12.55)	(8.264)
Observations	16,559	5,604	213	8,410	1,308	6,169	1,991	5,798
R-squared	0.024	0.035	0.655	0.040	0.119	0.051	0.070	0.020
Number of Households	8,006	3,778	206	4,700	960	3,430	1,509	3,707
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9A: Usual hours of work (Females)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Types of Work			
DEPENDENT VARIABLE:	*any work*	*salaried work*	*housework*	*self work*	*unpaid family work*	*agriculture*	*manufacturing*	*service*
Export Exposure	-20.49**	-40.17**	67.78	-21.64	72.24***	-68.76	-5.72	-23.03**
	(9.07)	(22.84)	(194.95)	(16.30)	(18.09)	(144.56)	(21.55)	(11.20)
Import Exposure	21.65**	37.14**	-69.96	27.24	-66.98***	106.11	-9.81	22.89**
	(8.90)	(17.76)	(181.13)	(17.10)	(18.77)	(151.53)	(24.31)	(9.97)
Age	0.652***	0.130	0.488	0.724*	0.706*	0.691***	-0.250	1.121***
	(0.206)	(0.480)	(0.621)	(0.435)	(0.406)	(0.264)	(0.609)	(0.345)
Age Squared	-0.0084***	-0.0045	-0.0088	-0.0085*	-0.0095**	-0.0085***	0.0032	-0.0121***
	(0.002)	(0.005)	(0.007)	(0.004)	(0.004)	(0.003)	(0.007)	(0.004)
Constant	25.27***	44.55***	22.44	24.32**	21.00**	17.89***	45.94***	10.38
	(4.33)	(9.85)	(15.91)	(9.93)	(8.90)	(5.84)	(12.26)	(7.18)
Observations	11,331	2,900	2,558	5,507	3,418	4,623	1,883	6,410
R-squared	0.014	0.058	0.139	0.015	0.065	0.049	0.062	0.023
Number of Households	6,208	2,082	2,231	3,536	2,349	2,740	1,385	3,917
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9B: Usual hours of work (Males)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Types of Work						
DEPENDENT VARIABLE:	*any work*	*salaried work*	*self work*	*construction*	*agriculture*	*manufacturing*	*service*
Export Exposure	-0.987	-2.438	-7.204	17.015	-90.346**	8.387	-2.701
	(3.84)	(4.41)	(18.67)	(18.91)	(35.13)	(9.53)	(4.73)
Import Exposure	1.147	1.586	10.306	-12.283	93.193***	-9.457	1.888
	(4.16)	(4.79)	(18.95)	(17.27)	(32.49)	(11.35)	(5.20)
Age	0.517***	0.770**	0.846***	0.789	0.822***	-0.417	0.674*
	(0.146)	(0.325)	(0.233)	(0.614)	(0.236)	(0.511)	(0.368)
Age Squared	-0.007***	-0.011***	-0.011***	-0.009	-0.010***	0.003	-0.007*
	(0.001)	(0.004)	(0.002)	(0.007)	(0.002)	(0.006)	(0.004)
Constant	43.77***	41.13***	28.73***	31.27**	30.03***	55.96***	31.73***
	(3.220)	(6.407)	(5.012)	(12.720)	(5.024)	(10.490)	(7.612)
Observations	16,529	5,589	8,397	1,307	6,154	1,989	5,789
R-squared	0.013	0.034	0.016	0.127	0.024	0.091	0.014
Number of Households	7,993	3,768	4,692	959	3,421	1,507	3,700
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered at the household level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Relative earned income of men over women in 2007 and log of exports in 2006 by province

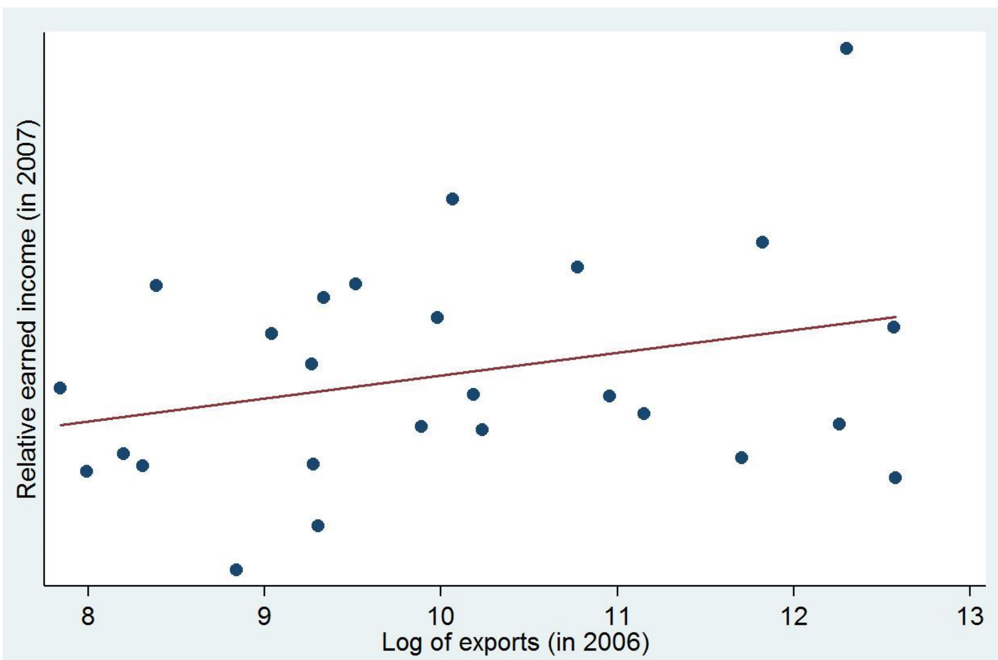


Figure 2: Jakarta in relation to other cities in Indonesia

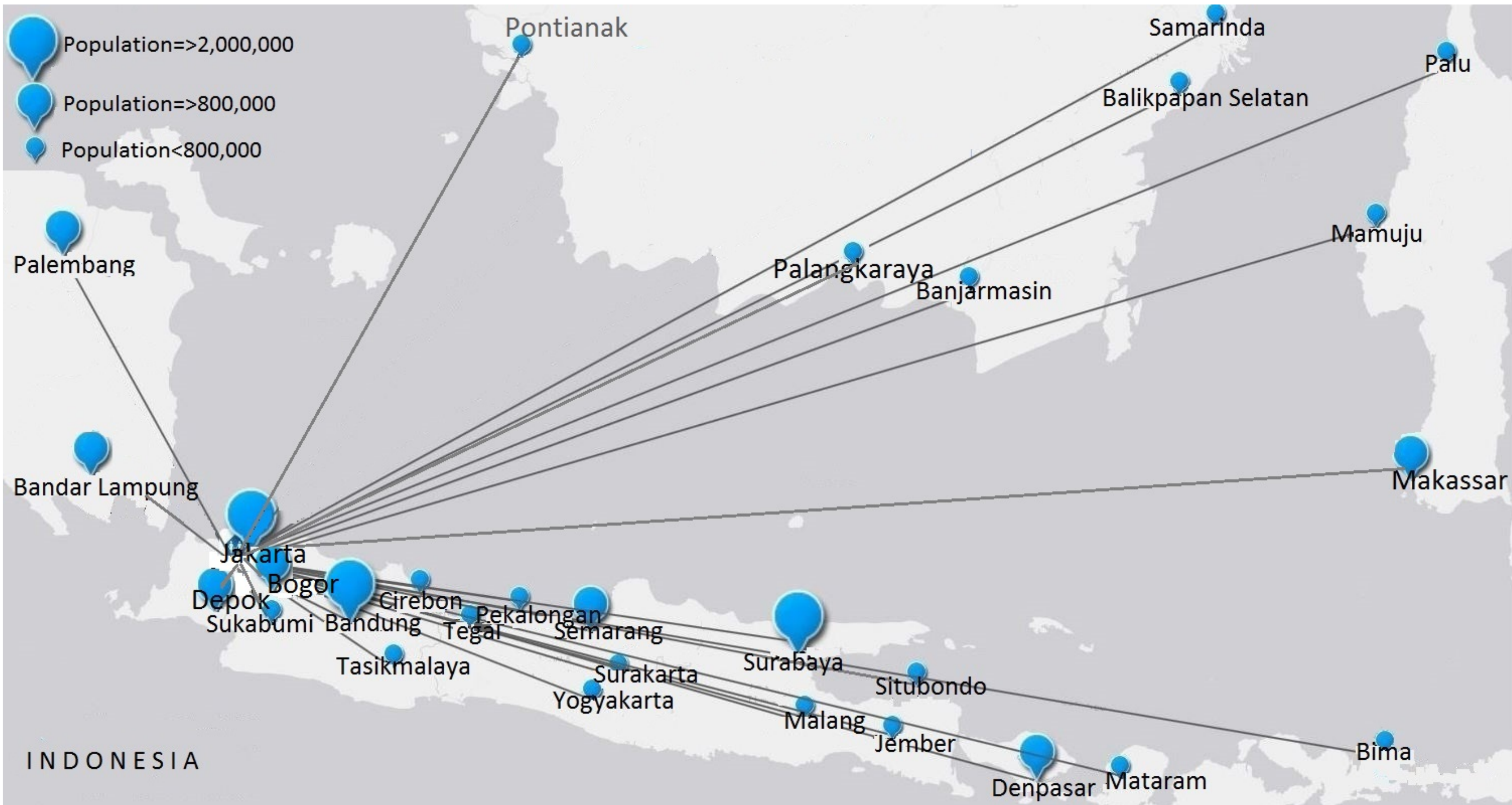
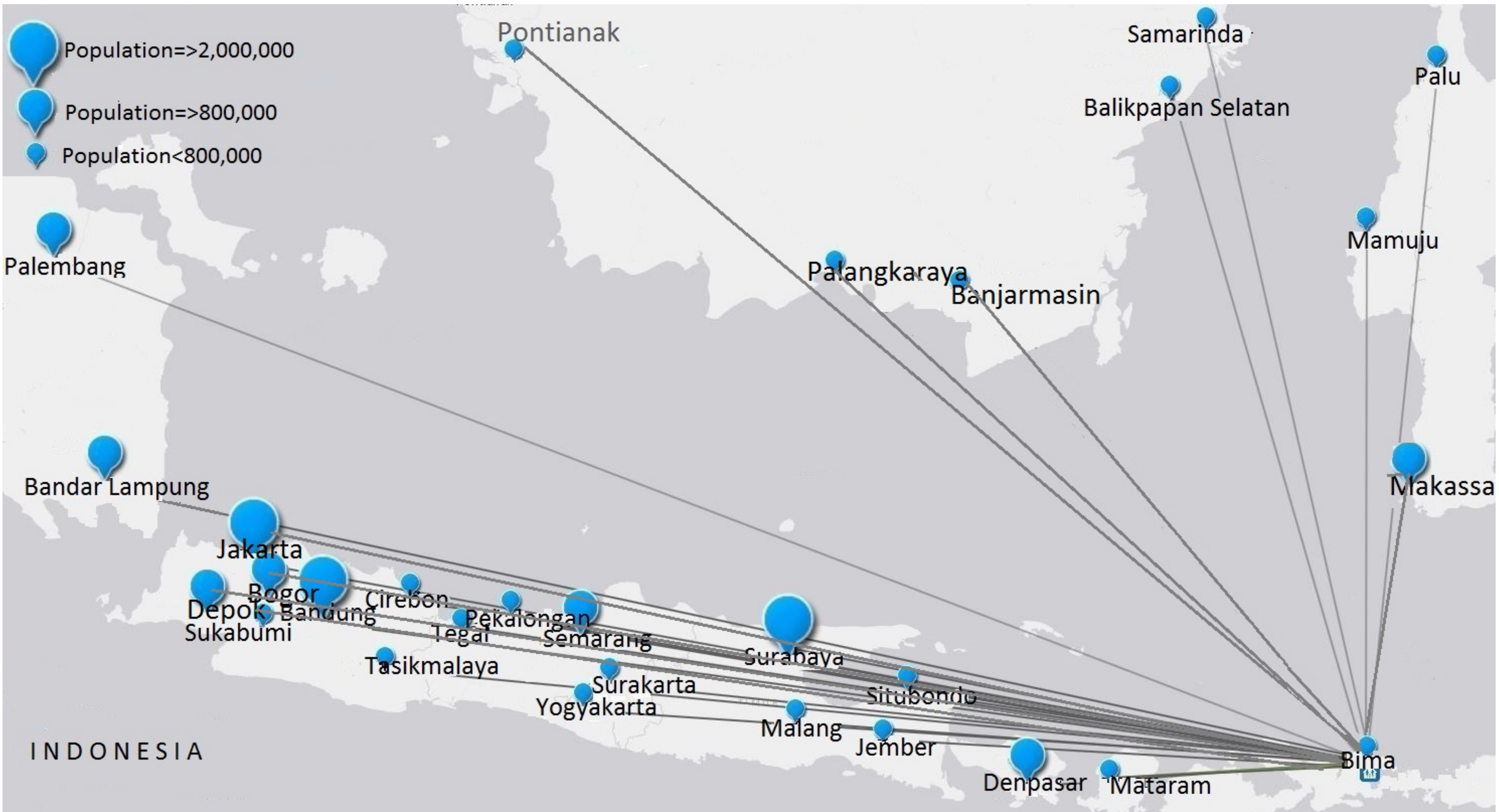


Figure 3: Bima in relation to other cities in Indonesia



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