The Real Exchange Rate, Structural Change, and Female Labor Force Participation*

Bilge Erten † Martina Metzger ‡

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Abstract

A large body of empirical work documents that targeting an undervalued real exchange rate stimulates the growth of tradable sectors and accelerates economic growth. We examine whether such growth reduces gender employment gaps by improving labor market opportunities for women. Combining an undervaluation index with data on female labor force participation and gender-specific sectoral employment, we find that countries that maintain an undervalued real exchange rate realize an increase in female labor force participation, and a corresponding decline in the difference between male and female labor force participation rates. This finding is particularly pertinent for developing countries and is robust to various specification checks as well as different estimation techniques. We also provide suggestive evidence that the operative channel is an expansion of female employment in manufacturing and industrial sectors.

Keywords: Undervaluation, female labor force participation, structural change, gender employment gaps, gender-specific labor market disparities, sector-specific growth, real exchange rate.

JEL Classification: J16, J21, F43

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†Department of Economics, 43 Leon Street, 312A Lake Hall, Northeastern University, Boston, MA 02115. b.erten@neu.edu.

‡Berlin School of Economics and Law, Germany. martina.metzger@hwr-berlin.de.

1 Introduction

Over the past three decades, emerging market economies have experienced rapid economic growth by adopting an export-oriented growth strategy to boost the international competitiveness of their goods and services. In many countries, a central component of this strategy has been the targeting of a competitive real exchange rate with a coordination of monetary and exchange rate policies. While this process has coincided with a general improvement in labor market outcomes, in many countries, female labor force participation rates remain low, and the gaps in labor market outcomes between men and women are far from closing (World Bank 2012; ILO 2016). The average female-to-male ratio in labor force participation ranges from 0.60 for developing economies to 0.85 for advanced economies (Stotsky et al. 2016). While previous studies have examined how an undervalued real exchange rate may stimulate the expansion of tradable sectors and real output growth, no research has examined whether such growth may assist in closing the gender labor force participation gap by improving labor market opportunities for women.

A large body of empirical work has documented that currency undervaluation stimulates economic growth by boosting the size of the tradable sectors that suffer disproportionately from institutional weaknesses and market failures (Rodrik 2008; Di Nino et al. 2011; Kappler et al. 2012; Gluzmann et al. 2012; Razmi et al. 2012; Habib et al. 2016). However, the impact of undervaluation on female labor force participation is theoretically ambiguous. On the one hand, if undervaluation stimulates the expansion of female-intensive traded sectors, particularly less technology-intensive manufacturing, this may reduce the gender employment gaps in developing countries that specialize in the production of such goods, including textiles, toys, and electronics assembly (Standing 1999; Kucera and Tejani 2014; Gaddis and Klasen 2014). On the other hand, undervaluation may stimulate the expansion of male-intensive traded goods such as mining and cash crop production or medium-technology manufacturing such as automobiles, which may widen gender-specific labor market disparities. Moreover, while non-traded, female-intensive services such as education, health, and public administration may contract, some of the traded female-intensive services such as tourism, finance, and retail may expand in response to undervaluation.

In this paper, we examine whether there is a robust relationship between real exchange rate undervaluation and female labor force participation. We use a comprehensive cross-country dataset to test whether currency undervaluation reduces gender inequality in employment by boosting female labor force participation. In general, the degree to which undervalued real exchange rates reduce gender employment gaps depends on which tradable sectors respond by expanding and preexisting patterns of specialization in a given country context. At earlier stages of development, undervaluation may boost the expansion of less technology-intensive manufacturing that tends to be more female intensive, leading to an increase in employment opportunities for women. At later stages of development, as wages increase and technological upgrading begins to occur, undervaluation may boost the more male-intensive traded sectors. As a result, the employment opportunities for women may become less abundant than those for men.

We combine various sources of country-level data from 1960 to 2015 at 5-year period intervals for a

maximum of 102 countries. Our dataset includes information on female labor force participation at different age intervals, an index of real exchange rate undervaluation, and various covariates of female labor force participation, including fertility rate, female and male education levels, capital stock as a share of the working population, and the urban share of population. We also use sector-specific female employment data to present evidence on the channels through which the effects of undervaluation on female labor force participation may operate.

We first estimate reduced-form relationships between the undervaluation of the currency and female labor force participation using country and period fixed effects. This specification allows us to measure the within-country effects of undervaluation on female labor force participation. One of the concerns with the reduced-form specification is that the result could be driven by reverse causality or omitted variable bias. Specifically, if there are positive technology shocks that lead to an expansion of production in female-intensive sectors, this could result in both an expansion of female labor force participation and an undervalued real exchange rate.[1] To address this concern, we complement the baseline estimates with an instrumental variable (IV) specification. We instrument the undervaluation index using two indicators: (i) the world capital flows interacted with the *de jure* Chinn-Ito index of capital account openness and (ii) the growth rate of foreign exchange reserves. These instruments have been used previously to predict undervaluation and test its effects on economic growth and were shown to be strong predictors of the real exchange rate changes (Habib et al. 2016). Using the same instruments, we examine whether undervaluation has a causal impact on female labor force participation.

Our primary results indicate a strong and robust positive relationship between undervaluation and female labor force participation. The estimates indicate that a 10 percent undervaluation is associated with an increase in female labor force participation of 3.4 percentage points per annum. This figure corresponds to a 7.1 percent increase relative to the outcome mean. The results are robust to these sample truncations and outliers, and there is little evidence of non-linearity in the relationship between undervaluation and female labor force participation. Moreover, we find that the interaction term between initial income and undervaluation is significant and negative in all specifications, indicating that the positive effect of undervaluation on female labor force participation is lower in countries with initially high income levels. In other words, the effect of undervaluation is stronger in lower-income countries. This finding is not surprising given that most of these countries specialize more in low-technology and more female-intensive manufactured goods, at least in the earlier stages of development. These results are robust to the inclusion of a large number of covariates and the use of alternative real exchange rate measures.

We further examine the heterogeneity among countries by testing whether there are differential effects of undervaluation by levels of economic development. We find no evidence of a significant association between undervaluation and female labor force participation in developed countries. In contrast, undervaluation has a

[1] Moreover, if there is an exogenous shock to female labor force participation that leads to an increase in the female labor supply, this shock may reduce wages in female-intensive sectors, which may in turn lead to lower output prices and an undervalued real exchange rate.

strong positive association with female labor force participation in developing countries. Similarly, the results indicate that undervaluation is positively and significantly associated with female labor force participation in non-OECD countries, while there is no evidence of a significant relationship in OECD countries. Our findings also show that the estimated effects are larger for the prime age group, particularly those between 30 and 44 years old, which implies that the jobs generated through undervaluation require some work experience compared to new entrants in the market.

We complement these reduced-form estimates by using an IV approach to address endogeneity concerns. Despite having a smaller sample due to limited data availability for the instruments used, the IV estimates indicate a significant and positive effect of undervaluation on female labor force participation, and the effects are larger for countries with initially lower levels of income. Thus, the evidence indicates that after addressing endogeneity concerns, we continue to find a robust positive impact of undervaluation on female labor force participation.[2]

We also examine whether undervaluation reduces the difference between male and female labor force participation rates. One concern could be that if undervaluation boosts the expansion of both female- and male-intensive sectors proportionally, it would fail to close the gender employment gap. Our results show that an increase in undervaluation leads to a decline in the difference between male-female labor force participation rates. The estimated effect implies that a 10 percent undervaluation is associated with a decline in the male-female labor force participation gap of 2.13 percentage points annually, which corresponds to a 6.45 percent decline in the average gap.

Finally, we provide a discussion of the channels through which the empirical regularities that we document operate. In particular, we find suggestive evidence that undervaluation boosts the expansion of employment opportunities for women in the manufacturing and industrial sectors, which in turn leads to a higher female labor force participation rate. In contrast, we find no evidence of a significant impact of undervaluation on female employment in the service or agricultural sectors.

Our work contributes to the growing literature on the relationship between the real exchange rate and economic growth. A large body of empirical studies have shown that overvaluation hurts economic growth (Razin and Collins 1997; Johnson et al. 2007; Rajan and Subramanian 2011). These studies documented that overvalued exchange rates are associated with the formation of unsustainably large current account deficits, shortages in foreign currency, rent-seeking and corruption, which tend to reduce economic growth. A related strand of the literature has analyzed whether the converse is also true: undervaluation stimulates growth (Rodrik 2008; Di Nino et al. 2011; Kappler et al. 2012; Gluzmann et al. 2012; Habib et al. 2016). An undervalued real exchange rate allows countries to maintain a high relative price ratio for traded goods with respect to non-traded goods, and given the potential for high-productivity growth in the traded goods sector, countries that shift resources into traded goods sectors attain higher rates of growth. Theoretical work

[2]In fact, the supply-side effects – such as positive productivity shocks to female-intensive sectors – are likely to bias the OLS estimates toward zero. Hence, the baseline results are conservative estimates of the effect of undervaluation on female labor force participation.

has demonstrated that the presence of learning-by-doing externalities in the traded goods sector provides an incentive for governments to subsidize this sector by using undervaluation as a policy tool (Aizenman and Lee 2010; McLeod and Mileva 2011; Benigno et al. 2015).[3] Our study contributes to this literature by examining whether undervaluation leads to a reduction in gender employment gaps by increasing the entry of women in the labor force.

A related body of literature focuses on the effects of real exchange rate changes on gender wage gaps. Using labor market data from the U.S., Goldberg and Tracy (2001) show that wages are sensitive to US dollar exchange rate volatility, particularly during periods of changing jobs. As women display higher job changing rates, Goldberg and Tracy (2001) find that female wages are more sensitive to exchange rate volatility than male wages. Munyo and Rossi (2015) analyze the gender impacts of fluctuations in the real exchange rate on wages in Uruguay. They find that a change in the real exchange rate can affect the wages of men and women differently due to their different labor representations in the exporting industry. Their findings show that a depreciation of the real exchange rate stimulates the traded sectors, which are manufacturing and mining. Since men predominantly work in the exportable manufacturing and mining industry, depreciation of the real exchange rate would result in an increase in wages of men relative to those of women. Our study complements these single-country studies that predominantly focus on gender wage gaps by examining the effects of undervalued exchange rates on female labor force participation using a comprehensive cross-country dataset from 1960 to 2015. We also provide a more long-term view of whether undervaluation may help reduce gender employment gaps over the long run, particularly in countries that specialize in female-intensive traded goods in their earlier stages of development.

Finally, our study relates to the extended literature on macroeconomic policies that may help reduce gender gaps in labor market outcomes. A large literature has examined the effects of fiscal policy on gender differences in economic outcomes. These studies argued that in adjusting the pace and composition of fiscal adjustments, policymakers need to take into account the harsher, short-term effects of economic austerity and structural adjustment measures on women to avoid exacerbating gender inequalities (Stotsky 2006; Elson and Cagatay 2000).[4] Gonzales et al. (2015) showed that biases in tax codes reduce incentives for women to participate in the labor market, and other legal barriers in owning assets tend to make it more difficult for women to access financial resources. On the other hand, fewer studies have focused on the effects of monetary policy on gender inequality. Braunstein and Heintz (2008) show that in contractionary inflation reduction periods, the ratio of female to male employment declines, indicating that women suffer more from employment losses than men. Singh and Zammit (2000) argued that women lose more than men from financial crises because of the additional burdens imposed on them in the absence of a publicly provided social security system. We contribute to this growing area of research by offering the first study to examine the effects of

[3]Similarly, Rodrik (2008) showed that tradable goods suffer disproportionately from institutional weaknesses and market failures, such as knowledge spillovers and credit market imperfections. Thus, correcting for these externalities using an undervalued real exchange rate tends to boost economic growth.

[4]The latter include cuts in childcare services and reductions in other public goods provision, which disproportionately increase the care burden of women and reduce their potential to actively participate in the labor market.

undervaluation on female labor force participation and providing detailed evidence from a comprehensive panel dataset.

The remainder of the paper proceeds as follows: Section 2 provides a conceptual framework for the relationship between undervaluation and female labor force participation. Section 3 describes the data. Section 4 presents the empirical strategy and results. Section 5 presents a discussion of the channels, and Section 6 concludes.

2 Conceptual Framework

We briefly discuss why an undervalued real exchange rate could affect the female labor force participation within countries, particularly those at earlier stages in their development. This discussion guides the empirical framework and analysis in Section 4.

A central ingredient for economic growth is the international competitiveness of a country's goods and services, particularly in the context of an export-led growth strategy. International competitiveness may be improved in two ways: (i) by generating a negative inflation differential to major competitor countries without a corresponding appreciation of the nominal exchange rate, or (ii) by devaluing the nominal exchange rate without a corresponding increase in the domestic price level. In both cases, a gain in competitiveness is reflected in an undervalued real exchange rate and an improvement in the trade balance. To be successful in such a strategy, monetary and exchange rate policies need to be consistent with each other.

A large body of research examines sustainable exchange rate regimes with a particular focus on developing and emerging economies, which are prone to the original sin of and the vulnerabilities associated with accumulating debt in foreign currency (Eichengreen et al. 2002; Fritz and Metzger 2006; Hausmann and Panizza 2012). There is a systemic trade-off between ensuring macroeconomic stability and enhancing international competitiveness for countries that accumulate foreign currency debt (Metzger 1999; Metzger and Taube 2011). Balance sheet effects based on currency and maturity mismatches have exposed many emerging markets to the fear of floating. Hence, many of them opted instead for fixed nominal exchange rates, which induced an overvaluation of the real exchange rate and limited the expansion of tradable goods and services.[5]

Targeting the real exchange rate as a monetary policy objective has received more attention recently, particularly in countries that have relied on export-oriented growth strategies. An undervalued real exchange rate may act as an effective means of increasing net exports and thus output as long as this strategy is implemented only by a small number of non-systemically important countries. Otherwise, the risk of the

[5]The majority of studies on this subject are devoted to overvalued exchange rates as a cause or at least a trigger of one of the various debt, currency or banking crises that developing countries have experienced since the mid-1970s (Metzger 2001; Williamson 2008). A related strand in the literature discusses overvaluation as a drag on development in terms of output and growth (Eichengreen 2008). Galindo et al. (2006) and Marquez and Pages (1997) show that overvaluation slows down the growth of industrial employment in Latin American and Caribbean countries. Possible transmission channels are the unfavorable stimulus of the nontradable sector to the disadvantage of the tradable sector and the loss of positive externalities linked to the traded sector.

emergence of depreciation spirals and currency wars may leave everyone worse off than before. Eichengreen (2008) and Eichengreen and Gupta (2012) emphasize that the real exchange rate matters for encouraging exports of goods and tradable services as long as it remains at a competitive level and strong volatility is avoided.[6]

Despite the extensive literature on real exchange rates, competitiveness, and growth, no previous research has examined the relationship between undervaluation and female labor force participation. It is useful to provide an outline of the mechanisms through which an undervalued real exchange rate may affect female labor force participation and gender employment gaps.

(i) The impact of an undervalued real exchange rate on the trade balance

This channel constitutes the core motivation of an export-led growth strategy. The transmission channel is the increase in price competitiveness, which induces a rise in the demand for exports and a decline in the demand for imports from the rest of the world. However, an undervaluation of the real exchange rate will result in an increase in net exports only if direct competitors will not have a similar improvement in their real exchange rates and if major importing countries will not resort to retaliation measures. This implies that the depreciation of several developing countries' currencies at the same time would not necessarily change the relative competitiveness between peers. Thus, the effect of an undervalued exchange rate strategy would be larger if the direct competitors depreciate their real exchange rates less and the major trading partners keep their markets relatively open to imported goods.

(ii) The impact of the increase in net exports on structural change and growth

An undervalued real exchange rate stimulates exports from the tradable goods sector, as the price of traded goods increases relative to that of non-traded goods. This effect leads to a structural change in the economy as resources move from non-traded sectors toward traded ones. Due to the higher productivity in traded sectors and positive externalities from technology spillovers, the expansion of traded sectors promotes higher levels of economic growth (Rodrik 2008; Di Nino et al. 2011; Kappler et al. 2012; Gluzmann et al. 2012; Habib et al. 2016). However, this effect will be dampened if the improvement of the real exchange rate is brought about by pursuing contractionary monetary or fiscal policies, which in turn lead to a reduction in investment and consumption expenditures. Such policies may result in a large enough decline in domestic absorption such that the rise in net exports could be neutralized. Countries undergoing long-lasting crises with unsolved external debt problems are often affected by such economic stagnation. On the other hand, countries that achieve undervaluation by limiting nominal wage increases in a boom phase would be able to limit inflationary effects and raise income generation. Moreover, countries that combine sterilized interventions with a relatively closed capital account have also been more successful in maintaining an undervalued real exchange rate, which in turn has boosted external competitiveness (Erten and Ocampo 2017). Hence, the types of undervaluation policies implemented to achieve undervaluation matter significantly in whether a

[6]The IMF has also argued that increasing international competitiveness should be a facilitating factor to accelerate growth by expanding market shares in both international and domestic markets (IMF 2015).

sustained economic growth phase is achieved.

(iii) The impact of structural change and growth on female labor force participation

A sustained period of economic growth is likely to result in an increase in employment.[7] To the extent that undervaluation stimulates economic growth in a sustained fashion, and periods of sustained economic growth tend to increase the labor force participation of women over time, an undervalued real exchange rate policy may lead to higher female labor force participation. However, theoretically, this effect is ambiguous for a number of reasons.

First, an undervalued real exchange rate implies an increase in the price of traded goods relative to non-traded goods, resulting in a reallocation of resources from non-tradable to tradable sectors. Rodrik (2008) has documented that undervaluation increases the size of the tradable goods sector. The expansion of the traded goods sector may stimulate the entry of women into the labor force if the expanding sectors are relatively more female labor intensive. For example, the production of textiles, garments, toys, and electronics assembly is female intensive, and to the extent that undervaluation provides an increased incentive to produce such goods in countries that are in earlier stages of development, undervaluation may lead to an increase in the demand for female labor. Several studies document that women have been engaged in export-oriented garment and other light manufacturing industries and that women have been subcontracted as own-account or piece-rate industrial laborers working at home or in small workshops (Seguino 2000; Ghosh 2004; Gaddis and Klasen 2014). In addition, some tradable service sectors may also be relatively female intensive, including tourism, finance, and retail services. To the extent that an undervalued real exchange rate stimulates the expansion of such traded services, it may also lead to a higher level of female participation in the labor force.

However, undervaluation may also act as a boost in expanding more male-intensive traded goods, including mining, cash crop production, or medium-technology manufacturing such as automobiles, other machine production, wood and metal fabrication. In addition, undervaluation may shift resources away from female-intensive non-traded sectors such as education, health, and public administration. In fact, the U-shaped relationship between female labor force participation and economic development is based on the notion that while agriculture and service sectors tend to be more female intensive, manufacturing has traditionally been male dominated (Goldin 1995). Yet, this simplification overlooks the introduction of more female-intensive technologies into manufacturing and the differences between cash crop production and subsistence farming; it is also not robust to dynamic estimation methods (Gaddis and Klasen 2014). Thus, the effects of undervaluation-induced inter-industry reallocation of resources on female labor force participation depends on whether the expanding traded sectors are more female intensive than the rest of the economy.

Second, the inter-industry effects of undervaluation on female labor force participation also depend on the effect of undervaluation on technological upgrading. If undervaluation stimulates the adoption of more

[7] In the short- to medium-term, however, the margin of adjustment is ambiguous. Employment may increase by expanding the working hours of those already employed, in which case labor force participation would not change. Alternatively, employment could also expand by increasing the number of employed, which would boost labor force participation. In the long run, however, we would expect a rise in labor force participation as a result of a sustained GDP growth based on a rise in net exports.

capital-intensive production methods, it may also lead to a reduction in female employment in previously more labor-intensive manufacturing sectors. Such technological upgrading has resulted in a decline in the female labor force participation rates in several East Asian countries, including Malaysia and South Korea (Tejani and Milberg 2016). On the other hand, if the country continues to have a comparative advantage in labor-intensive products, undervaluation may also stimulate the expansion of more labor-intensive production, some of which may be female intensive. For example, China has benefited from an undervalued real exchange rate in stimulating its labor-intensive manufacturing sectors, including textiles, garments, and toys, which have absorbed large amounts of female labor (Kucera and Tejani 2014).

Finally, an undervalued real exchange rate may also result in technological changes within industries by making it more profitable to switch toward production methods with less physically demanding skills. In particular, a depreciated real exchange rate may stimulate production for export markets and induce technological upgrading (Verhoogen 2008). Firms may then switch from more physically demanding skills in which men have a comparative advantage toward less physically demanding skills with more computer use and cognitive input in which women have a comparative advantage. Juhn et al. (2014) show that in Mexico, the increased incentives to export through trade liberalization led to the adoption of production methods with less physically demanding skills and increased the employment of women in blue-collar positions. Hence, technological changes introduced to increase competitiveness in external markets may also have a positive impact in increasing the employment opportunities for women, particularly in lower-skill segments of the labor force.

3 Data

The empirical analysis incorporates three primary sources of data: the gender-specific labor force participation and sectoral employment data, the undervaluation index, and other time-varying, country-specific variables. We will discuss each data source in turn.

3.1 Gender-specific labor force participation and sectoral employment data

The primary outcomes of interest are gender-specific labor force participation rates provided by the Key Indicators of the Labor Market (KILM) ILO database. Specifically, we use internationally comparable data on the labor force participation rate by sex and age in 5-year time periods from 1960 to 2015 for a maximum of 102 countries. Our main variable of interest is the average female labor force participation rate. However, we also examine female labor force participation rates for different age groups, including the ages of 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49. In addition, we are interested in the difference between the male and female labor force participation rates, which we construct by subtracting the average female labor force participation rate from the average male labor force participation rate.

In the analysis of channels underlying the empirical regularities that we document, we also use ILO data

on female employment by sector, focusing on four sectors: manufacturing, industry (including manufacturing and mining), services, and agriculture. In the regression analysis, we use the female employment growth rates in these sectors in 5-year increments from 1960 to 2015. These data are available only for about half of the full sample.

Table 1 provides summary statistics for these outcome variables. The average female labor force participation rate is 48%, which is slightly lower than the age-specific female labor force participation rates since it includes younger and older women who participate at lower rates. The standard deviation of the overall female labor force participation is 19%, which is fairly large, and the large range of minimum and maximum values also indicates a high degree of variation in female labor force participation across countries and over time. The average male labor force participation rate is 80%, and the average difference between male and female labor force participation rates is 32%. Given this rather substantial difference, an important question of interest is whether undervaluation may lead to a decline in the gender labor force participation gap.

3.2 An Index of Undervaluation

Our primary analysis seeks to identify the effect of a real exchange rate undervaluation on the participation of women to the labor force. To estimate the impact of undervaluation, we follow Rodrik (2008) to construct an index of undervaluation that is comparable across countries and over time:

$$lnUNDERVAL_{it} = lnRER_{it} - \widehat{lnRER_{it}} \tag{1}$$

where $lnUNDERVAL_{it}$ is the log of an undervaluation index for country i at time period t, $lnRER_{it}$ is the log of the real exchange rate for country i at time period t, and $\widehat{lnRER_{it}}$ are the predicted values from the following equation to adjust for the Balassa-Samuelson effect:

$$lnRER_{it} = \alpha + \beta lnRGDPPC_{it} + \lambda_t + v_{it} \tag{2}$$

where $lnRGDPPC_{it}$ is the log of real GDP per capita for country i at time period t, and λ_t are time period fixed effects to control for worldwide macroeconomic events.

The Balassa-Samuelson adjustment is required to account for the fact that non-traded goods are cheaper in poorer countries. On average, a 10% increase in the real GDP per capita is associated with a 2.4% appreciation of the real exchange rate (Rodrik 2008). Computed in this way, the undervaluation index is comparable across countries and over time. In cases where the index is greater than one imply that the goods produced at home are cheap in dollar terms and that the currency is undervalued. In cases when it is less than one, the currency is overvalued. We use a standardized undervaluation index with a mean of zero and a standard deviation of 1.

For the construction of the undervaluation index, we use the real exchange rate data from the Penn World Tables 8.1, which covers a more extensive set of countries over longer periods of time compared to the

data from *International Financial Statistics* from the IMF. The data on real GDP per capita are also derived from the Penn World Tables 8.1. In addition, we complement our baseline analysis by using alternative real exchange rate measures that are not adjusted for the Balassa-Samuelson effect, showing that these constitute lower bounds on the estimated relationships. Specifically, we use the unadjusted real exchange rate measures from the Penn World Tables 8.1 and the *International Financial Statistics* from the IMF.

3.3 Other time-varying country-specific data

The third set of data we use includes other time-varying country-specific variables. These enter into our analysis as control variables. The data on fertility rates capture the average number of children that would be born to a woman over her fertile life if she were to experience the current age-specific fertility rate through these years.[8] These data come from the *World Development Indicators* of the World Bank. The proxies for female and male education are the average years of schooling among females and males above the age of 15 (Barro and Lee 2001). The data on the capital stock per working-age population is calculated by the total capital stock in 2004 US$ PPP from the Penn World Tables 6.2 divided by the population in the age groups 1564 (Bloom et al. 2009). Finally, the data on the percent of the total population living in an urban area come from the *World Development Indicators* of the World Bank.

In addition, we use data on capital account openness, its interaction with world capital flows, and the foreign exchange reserves accumulated by individual countries to construct instruments for the undervaluation index. This data comes from the *International Financial Statistics* from the IMF.

Table 1 includes summary statistics for these variables. The average fertility rate is 4 children per woman. The average years of schooling is 5.17 years for women and 5.97 years for men. The capital per working-age person is 26% on average, and the urban population is 52% of the total on average. The average Chinn-Ito capital account openness index is 46%, the average of its interaction with world capital flows is 29%, and the average of the log difference of foreign exchange reserves is 11%.

4 Empirical Results

4.1 Baseline Specification

The sample includes a maximum of 102 countries and twelve 5-year time periods from 1960 to 2015. We use a fixed-effects specification to analyze the effect of changes in undervaluation on the changes in average female labor force participation rates within countries. Our baseline specification for estimating the relationship

[8] A large body of empirical work has documented the effects of fertility on female labor force participation. See for example McNown and Rajbhandary (2003), Martínez and Iza (2004), Bloom et al. (2009), and Salamaliki et al. (2013).

between female labor force participation and undervaluation takes the form:

$$FLFP_{it} = \alpha + \beta lnUNDERVAL_{it} + X'_{it}\sigma + \eta_i + \nu_t + u_{it} \tag{3}$$

where $FLFP_{it}$ is the female labor force participation rate in country i at time period t, $UNDERVAL_{it}$ is the undervaluation index of country i at time period t, X'_{it} is a vector of time-varying control variables at the country level, η_i are country fixed effects that control for time-invariant heterogeneity at the country level, and ν_t are time period fixed effects that control for unobserved worldwide changes each year. Among the control variables at the country level, X'_{it}, we include the initial income level as a standard convergence term, its interaction with the undervaluation index, as well as other important determinants of female labor force participation, such as fertility rate, female education, male education, capital stock as a share of the working-age population, and the share of urban population. The reduced-form estimates are obtained by ordinary least squares (OLS) with country and year fixed effects. Given the fixed-effects framework, we estimate the "within" effect of undervaluation, namely, the impact of changes in undervaluation on changes in female labor force participation rates within countries. The primary coefficient of interest is $\hat{\beta}$. We present the regression results with additional covariates, alternative undervaluation measures, different samples of countries, and alternative age groups of women in the robustness analysis in Section 4.2.

The results from estimating Eq. 3 are provided in Table 2. The dependent variable is the average female labor force participation rate observed in 5-year intervals from 1960 to 2015. Column 1 shows that when controlling for initial income level and its interaction with undervaluation, undervaluation has a strong positive relationship with the female labor force participation rate. The estimate suggests that a 10% undervaluation is associated with an increase in female labor force participation of 3.4 percentage points per annum (0.10 x 0.34). This figure corresponds to a 7.1% increase relative to the outcome mean. As a robustness exercise, in columns 2–6, we reestimate the baseline specification for different ranges of the undervaluation index to check whether the estimate in column 1 is robust to the presence of potential outliers. The estimated coefficients remain significant at 1 to 5% levels and they are fairly stable, ranging from 0.279 to 0.371. Thus, the baseline estimate is robust to various sample truncations, and there is little evidence of non-linearity in the relationship between undervaluation and female labor force participation.

A related result from Table 2 is that the estimated coefficient of the interaction term between initial income and undervaluation is significant and negative in all specifications. This result indicates that the positive association between undervaluation and female labor force participation is lower in countries with initially higher income levels. We test whether the results are driven by countries with lower income levels in Section 4.2.3.

4.2 Robustness Analysis

4.2.1 *Additional Covariates*

In the specifications reported in Table 2, we have controlled only for the level of initial income and its interaction with the undervaluation index, in addition to country and time fixed effects. Although the fixed effects account for any factors that are country specific and time invariant or time specific and country invariant, it is plausible that there are time-varying, country-specific determinants of female labor force participation and that omitting them would generate omitted variable bias. Thus, as a robustness check, we include additional covariates, including the fertility rate, female education, male education, capital stock as a share of working age population, and the share of urban population, to check whether the estimates are sensitive to the inclusion of these factors.

Table 3 reports the results. The estimated coefficient of the undervaluation index remains positive and significant in all specifications, and its interaction with initial income continues to be negative and significant. Moreover, despite the addition of a large number of covariates, the coefficient estimates do not vary much (from a low of 0.355 to a high of 0.371) and remain robust across different specifications.

4.2.2 *Alternative Measures of Real Exchange Rates*

One concern with the construction of the undervaluation index is that the Balassa-Samuelson effect may result from supply-side effects. Although the adjustment is appropriate when the Balassa-Samuelson effect results from the demand-side channel (as national income affects the price level represented in Eq. (2)), it may create an upward bias when it is driven by supply-side factors. For example, if there is a positive productivity shock that results in both higher female labor force participation and price levels, the coefficient estimates of the undervaluation index may be biased upward. Thus, in Table 4, we use alternative measures of real exchange rates without adjusting them for the Balassa-Samuelson effect. In the presence of Balassa-Samuelson effects resulting from the demand side, the estimates using unadjusted real exchange rates are likely to be biased downward. Hence, they can be considered a lower bound estimate of the effect of undervaluation on the female labor force participation rate.

In Table 4, columns 1-3 report the results using the unadjusted real exchange rate index from the Penn World Tables, and columns 4-6 report the results using the unadjusted real exchange rate index from the International Financial Statistics (IFS) from the IMF. The latter measure is available only for a very restricted sample, resulting in a size approximately half that of the original sample. The coefficient estimates for the undervaluation index remain significant and positive across all specifications. For columns 1-3, the estimates range from 0.269 to 0.289, while for columns 4-6, they range from 0.334 to 0.249, which are rather close but somewhat lower than the baseline estimate of 0.340. Thus, as a lower bound, we could take the smallest estimate as a reference, which implies that a real exchange rate undervaluation of 10% is associated with an increase in the female labor force participation rate of 2.49% per annum (0.10 x 0.249) as a conservative

estimate.[9]

4.2.3 *Different Samples of Countries*

If the effect of undervaluation on female labor force participation operates through the expansion of the tradable goods sector, which is more female intensive at earlier stages of development (e.g., production of textiles, electronics assembly), the positive association that we have so far documented between undervaluation and female labor force participation is likely to be driven by developing countries as opposed to high-income countries. We examine the heterogeneity among countries by testing whether there are differential effects of undervaluation by per capita income level and by whether a country is an OECD member.

Table 5 provides the results. Column 1 reports the baseline estimation that includes all countries. Column 2 restricts the sample to countries with real income per capita above $7,500, while column 3 restricts it to those with real income per capita above $7,500. As the estimates in columns 2 and 3 reveal, the baseline estimate is clearly driven by the developing countries, and we find no evidence of a significant association between undervaluation and female labor force participation in more developed countries. Columns 4 and 5 perform a similar comparison between OECD and non-OECD countries. The estimates indicate that undervaluation is positively and significantly associated with female labor force participation in non-OECD countries, while there is no evidence of a significant relationship for OECD countries. Overall, the results support the hypothesis that the boost in female labor force participation resulting from the stimulus of an undervalued real exchange rate depends strongly on a country's level of development. At earlier stages of development, undervaluation may stimulate female labor force participation in low-technology tradable goods sectors that tend to be more female intensive on average. This stimulus effect would disappear at higher income levels as more high-technology sectors tend to employ women less intensively.

4.2.4 *Female Labor Force Participation in Different Age Groups*

Another concern could be that the estimates we provide apply only to the average of female labor force participation and may not hold across different age groups if women face different barriers to entering the labor market at different ages. To account for this heterogeneity, we examine whether the relationship between undervaluation and female labor force participation varies by age group.

In particular, we estimate a variant of Eq. (3) using age-specific female labor force participation rates:

$$FLFP_{ait} = \alpha_a + \beta_a UNDERVAL_{it} + X'_{it}\sigma_a + \eta_{ai} + \nu_{at} + u_{ait} \tag{4}$$

where $FLFP_{it}$ is the female labor force participation rate of age group a in country i at time period t, $UNDERVAL_{it}$ is the undervaluation index of country i at time period t, X'_{ait} is a vector of time-varying

[9] In fact, both sets of OLS estimates may be downward biased due to the endogeneity of undervaluation to female labor force participation. We discuss this issue in Section 5.3 and provide an alternative specification using an IV approach. We show that the IV estimates are an order of magnitude larger than the OLS estimates.

control variables at the country level, η_{ai} are country fixed effects that control for time-invariant heterogeneity at the country level, and ν_{at} are time fixed effects that control for unobserved worldwide changes at each time period. Each of the parameters, country fixed effects and time fixed effects can vary by age group a, and we run the regressions for the female labor force participation of each age group separately.

The results in Table 6 show that the estimated effects are larger for the prime age group, particularly those between 30 and 44, and the smallest effects are estimated for the youngest group, those between 20 to 24 years old. This finding could be indicative of the fact that a boost in labor demand through undervaluation policies generates jobs for relatively more experienced prime age workers as opposed to those who are recent entrants to the job market. In addition, the prime age group includes women who are willing and prepared to join the labor market but have the least opportunity to do so due to their household responsibilities in unpaid care activities. Hence, an undervaluation-driven demand boost may have a stronger impact in pulling them back into the labor force as well-paid jobs in female-intensive sectors begin to emerge.

4.3 Instrumental Variables Specification

While Tables 1-6 have clearly demonstrated a strong association between undervaluation and female labor force participation, the result could be driven by reverse causality or omitted variable bias. In particular, if there are positive technology shocks that lead to an expansion of production in female-intensive sectors, this could result in both an expansion of female labor force participation and an undervalued real exchange rate due to the availability of more-cost efficient technologies. Moreover, an exogenous shock to female labor force participation that leads to an increase in female labor supply might reduce wages in female-intensive sectors, which in turn may lead to lower output prices and an undervalued real exchange rate. These supply-side effects would bias the OLS estimates toward zero.

In order to address these concerns, we implement an IV approach by instrumenting undervaluation with exogenous global pull/push factors that lead to changes in capital flows to individual countries. In particular, we follow Habib et al. (2016) in using two instruments for undervaluation: (i) world capital flows interacted with the *de jure* Chinn-Ito index of capital account liberalization at time *t-1*, and (ii) the growth rate of foreign exchange reserves. Habib et al. (2016) have shown that these instruments are strong predictors of changes in the real exchange rate. A fall in world capital flows leads to undervaluation in individual countries that are particularly open to capital flow transactions, a rise in sterilized reserve accumulation leads to an undervalued real exchange rate, and vice versa. Since our specification also has an interaction term with initial income, we also use interactions of these instruments with initial income as additional instruments in the specification.

Table 7 presents the results. We fail to reject the Hansen test of overidentifying restrictions, indicating that the IV specifications are not overidentified. The coefficient estimates appear to be much larger, ranging from 0.89 in column 1 to 0.94 in the most saturated specification in column 5. However, our IV estimates of the effects of undervaluation on female labor force participation rate are likely to be conservative, underestimating

this effect by roughly 15%. The underlying reason for this downward bias is that the IVs fail to completely correct for endogeneity in small samples in the presence of weak instruments or many instruments, biasing the IV estimates in the direction of the OLS results.[10]

On the conservative side, the estimate in column 1 implies that a 10% undervaluation leads to an increase in female labor force participation rate of 8.9 percentage points (0.10 x 0.89). This result corresponds to an 18.5% increase relative to the outcome mean. This finding is in line with the findings of Habib et al. (2016), who show that the growth effects of undervaluation are much larger when the endogeneity bias is corrected using an IV specification.

In sum, despite the restrictions in data availability from 1980 to 2010 and the resulting smaller sample, the results continue to indicate a significant and positive effect of undervaluation on female labor force participation, and the effects are larger for countries with initially lower levels of income, as shown by the interaction term. Thus, the evidence indicates that when addressing endogeneity concerns, we continue to find a robust positive impact of undervaluation on female labor force participation.

4.4 Difference in Labor Force Participation between Men and Women

In this section, we examine whether the difference in male-female labor force participation rates becomes smaller in response to an increase in undervaluation. This examination is important because it could be that undervaluation leads to an increase in both female- and male-intensive sectors without having a disproportionate impact on female employment. In this case, the gender employment gaps would remain intact despite an overall improvement in employment opportunities for both men and women. To test whether women disproportionately benefit from undervaluation, we examine whether undervaluation reduces gender gaps in labor force participation.

Table 8 presents the results, which indicate that an increase in undervaluation leads to a decline in the difference between male-female labor force participation rates. The coefficient estimate from the fully saturated specification in column 5 implies that a 10% undervaluation is associated with a decline in male-female labor force participation gap of 2.13 percentage points annually (0.10 x -0.213). This result corresponds to 6.45% decline in the average male-female labor force participation gap, indicating a large overall impact. The interaction coefficient is positive and significant, implying that the reduction in the gender labor force participation gap is smaller for countries with initially higher levels of income. This finding again supports that the channel through which undervaluation stimulates female labor force participation and thereby reduces the gender gap in labor force participation operates primarily for lower income countries that have a comparative advantage in female-intensive export sectors. Thus, we find no evidence that the effects of

[10]For an insightful discussion of this issue, see Stock and others (2002). The partial F-statistic of the excluded instruments, a statistic commonly used to test the strength of instruments, is 12% for the interaction term between undervaluation and initial income and 6% for the undervaluation index. Using the StockYogo weak identification test critical values, the IV relative bias decreases by roughly 15%. Because the OLS estimates are much smaller than the IV estimates and the IV estimates are biased toward the OLS results in cases of weak instruments, the true coefficients are approximately 15% higher than those reported in Table 7.

undervaluation is gender neutral. The results imply the opposite, that women benefit disproportionately more from an undervalued real exchange rate, particularly in developing countries.

5 Discussion of Channels

Since the real exchange rate represents the price of traded goods in terms of non-traded goods, an increase in the real exchange rate raises the profitability of the traded goods sector and results in its expansion. Initially, this effect may lead to a contraction in the relative size of non-tradables, but there could be second-round effects from the aggregate demand expansion, which may lead to a subsequent expansion in some service sectors, such as finance and retail, that benefit from spillovers from industrial sectors. However, the impact of a rise in the real exchange rate on female-intensive sectors – either in tradables or non-tradables – remains an empirical question and is likely to depend on the comparative advantage and past patterns of specialization of the given country at different stages of development. For example, if an undervalued real exchange rate stimulates the expansion of textile production in a developing country, this may lead to an increase in employment opportunities for women. Conversely, if non-tradable services contract, e.g., in health or education sectors, undervaluation may have negative impacts on the employment of women. To examine which channels dominate in explaining the positive relationship we have documented between undervaluation and female labor force participation, we use data on the growth rates of female employment in different sectors and test which sectors have a positive response to undervaluation.

Table 9 provides two sets of results. First, in columns 1-4, we regress five-year average growth rates of female employment in manufacturing, industry (including manufacturing and mining), services, and agriculture, controlling for income levels, a full set of country and time fixed effects, and the undervaluation index.[11] The results in columns 1 and 2 show a strong positive association between undervaluation and female employment growth in both the manufacturing and industrial sectors. In contrast, we find no evidence of a significant relationship for undervaluation and female employment growth in the services or agricultural sectors. The magnitudes of the estimates suggest that a 10% undervaluation is associated with a 6.96% increase in the employment growth of women in manufacturing, which corresponds to 20% of one standard deviation of the outcome variable. The same degree of undervaluation is associated with a 6.08% increase in the employment growth of women in industrial sectors, corresponding to 18% of one standard deviation of the outcome variable. In other words, undervaluation has a strong relationship with boosting the employment opportunities of women in manufacturing and industrial sectors, with no evidence of a significant effect in agriculture or services.

Second, columns 5–8 provide two-stage least squares estimates that use undervaluation as an instrument for female employment growth in different sectors and an examination of its impact on female labor force

[11] Due to data availability, we have a much smaller sample for female employment results. Thus, we present these results as suggestive evidence for the channels through which undervaluation may have sector-specific effects in terms of its relationship to female labor force participation.

participation. This approach allows for testing whether the undervaluation-induced component of female employment growth in different sectors stimulates female labor force participation. We find parallel results that an increase in undervaluation leads to an expansion of female employment in manufacturing and industrial sectors, which in turn enhances female labor force participation. We find no evidence of a significant impact that operates through female employment in the services or agricultural sectors.

Overall, given the restricted sample due to data availability, we interpret these results as suggestive evidence for the channels through which undervaluation may have an association with female labor force participation. The findings suggest that undervaluation boosts the expansion of employment opportunities for women in manufacturing and industrial sectors, which in turn leads to a higher female labor force participation rate on average.

6 Conclusion

The main objective of this paper is to provide evidence of the effect of an undervalued real exchange rate on female labor force participation. Using a comprehensive cross-country dataset from 1960 to 2015 for 102 countries and addressing endogeneity concerns using an IV strategy allows us to estimate the causal effects of undervaluation on female labor force participation. While previous studies have established a strong and positive effect of undervaluation on economic growth, there is no evidence as to whether such growth reduces the gender employment gap by improving labor market opportunities for women. The key contribution of this paper is the assessment of the effect of undervaluation on female labor force participation and whether this effect results in a reduction in gender employment gaps.

We find that undervaluation stimulates female labor force participation and that the effects are stronger for developing countries. Our estimates indicate that a 10% undervaluation is associated with an increase in female labor force participation of 3.4 percentage points per annum, corresponding to a 7.1% increase relative to the outcome mean. The results are robust to sample truncations and outliers, and there is little evidence of non-linearity in the relationship between undervaluation and female labor force participation. We also find a stronger impact for developing countries, which may not be surprising given that most of these countries specialize more in low-technology and relatively more female-intensive manufactured goods, at least in the earlier stages of development. These results are also robust to the inclusion of a large number of covariates and the use of alternative measures of real exchange rates.

Our findings also show that the estimated effects are larger for the prime age group, which implies that the jobs generated through undervaluation require some work experience compared to new entrants in the market. Moreover, our IV estimates are in line with our reduced-form estimates in that undervaluation that is driven by exogenous events, such as a rise in global capital flows, also has a positive impact on female labor force participation. Our findings also show that undervaluation not only increases the entry of women in the labor force but also reduces the gap between men and women in labor force participation. Finally,

we provide suggestive evidence that the empirical regularities that we document work through an increase in female employment in the manufacturing and industrial sectors rather than in services or agriculture.

Our results suggest important policy implications for developing countries, particularly for those in earlier stages of their development. Our results indicate that the positive effect of undervaluation on female labor force participation is stronger in developing countries where gender employment gaps are also the largest, implying that there may be opportunities for interventions to target a more undervalued real exchange rate in these countries. Various policies may be used to target a more undervalued real exchange rate. Exchange rate regimes with a managed float or a devaluation followed by a stabilization of the nominal exchange rate are associated with a more undervalued real exchange rate compared to a rigid nominal anchor (e.g. a peg, a currency board, or a currency union). Moreover, recent research suggests that these exchange rate regimes have to be accompanied by other policies, such as foreign exchange accumulation and capital flow management, in order to have sustainable effects on export performance and, consequently, labor market expansion. Overall, it is important to have a coordinated macroeconomic policy framework in which fiscal, monetary, and exchange rate policies are countercyclically adjusted not only to smooth out business cycle fluctuations, but also to raise long-term growth potential and reduce longstanding gender employment gaps.

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Table 1: Summary Statistics

Variable	(1) Mean	(2) SD	(3) Min	(4) Max	(5) Obs
Female labor force participation, average	0.48	0.19	0.06	1.00	991
Female labor force participation, age 20-24	0.55	0.18	0.06	1.00	984
Female labor force participation, age 25-29	0.58	0.20	0.07	1.00	986
Female labor force participation, age 30-34	0.58	0.21	0.07	1.00	981
Female labor force participation, age 35-39	0.59	0.22	0.07	1.00	982
Female labor force participation, age 40-44	0.59	0.23	0.07	1.00	984
Female labor force participation, age 45-49	0.57	0.23	0.07	1.00	981
Male labor force participation, average	0.80	0.08	0.48	0.99	886
Difference between male and female labor force participation	0.32	0.19	-0.14	0.78	852
Fertility rate	0.04	0.02	0.01	0.08	1022
Average years of schooling, female age >15 years	5.17	3.25	0.04	13.23	927
Average years of schooling, male age>15 years	5.97	2.97	0.26	13.36	927
Capital per working-age person	0.26	0.31	0.00	1.38	1005
Urban population as a share of total	0.52	0.25	0.03	1.00	1022
Ln undervaluation index	0.00	1.00	-1.96	2.30	1025
Ln undervaluation index interacted with ln initial income per person	-0.58	8.75	-22.96	22.19	1025
Ln initial income per person	8.57	1.19	5.62	11.71	1025
Ln current income per person (based on real GDP)	8.65	1.22	5.62	11.94	1025
Real GDP per person in USD	11,052	13,476	276	153,246	1025
Ln real exchange rate, PWT	1.15	0.74	-0.43	3.40	1025
Ln real exchange rate, IMF	4.69	0.58	3.68	14.65	471
Chinn-Ito capital account openness index	0.46	0.36	0.00	1.00	772
World capital flows interacted with capital account openness index	0.29	0.50	-0.58	2.59	772
Foreign exchange reserves in USD (log differenced)	0.11	0.51	-2.14	5.20	898
Growth rate of female workers in manufacturing	0.07	0.35	-0.90	2.88	422
Growth rate of female workers in industry	0.09	0.33	-0.49	2.80	420
Growth rate of female workers in services	0.20	0.29	-0.40	4.52	420
Growth rate of female workers in agriculture	0.07	0.54	-0.91	6.12	419

Notes: The mean, standard deviation, minimum, maximum and number of observations for key variables are reported for the full sample. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 2: Panel Evidence on the Relationship between Undervaluation and Female Labor Force Participation: Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	*UNDERVAL* greater than negative 100%	*UNDERVAL* greater than negative 50%	*UNDERVAL* greater than negative 25%	*UNDERVAL* less than positive 25%	*UNDERVAL* less than positive 50%	*UNDERVAL* less than positive 100%
ln *UNDERVAL*	0.340***	0.371***	0.341***	0.279***	0.308**	0.328***	0.280***
	(0.088)	(0.095)	(0.081)	(0.068)	(0.120)	(0.116)	(0.105)
ln *initial income* * ln *UNDERVAL*	-0.032***	-0.032***	-0.030***	-0.029***	-0.051***	-0.049***	-0.044***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.012)	(0.011)	(0.009)
ln *initial income*	0.043***	0.050***	0.058***	0.059***	-0.111***	-0.079***	-0.072***
	(0.013)	(0.012)	(0.010)	(0.009)	(0.029)	(0.025)	(0.023)
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes	yes
Observations	991	840	642	536	641	720	768

Notes: The dependent variable is the average female labor force participation rate measured in 5-year time periods from 1960 to 2015 (Mean: 0.48, Std. dev.: 0.19). Robust standard errors are clustered at the country level. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 3: Panel Evidence on the Relationship between Undervaluation and Female Labor Force Participation: Fixed Effects With Additional Covariates

	(1)	(2)	(3)	(4)	(5)
ln *UNDERVAL*	0.340***	0.369***	0.368***	0.371***	0.355***
	(0.088)	(0.079)	(0.083)	(0.082)	(0.088)
ln *initial income* * ln *UNDERVAL*	-0.032***	-0.033***	-0.032***	-0.033***	-0.031***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.006)
ln *initial income*	0.043***	0.044***	0.049***	0.049***	0.046***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.016)
Fertility rate		-0.807	-0.681	-0.715	-0.896
		(0.803)	(0.785)	(0.800)	(0.804)
Female education			0.001	-0.003	-0.003
			(0.008)	(0.011)	(0.011)
Male education				0.005	0.005
				(0.010)	(0.010)
Capital stock (as a share of working age population)					0.024
					(0.087)
Urban population (as a share of total population)					-0.057
					(0.103)
Country fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	991	989	896	896	893

Notes: The dependent variable is the average female labor force participation rate measured in 5-year time periods from 1960 to 2015 (Mean: 0.48, Std. dev.: 0.19). Robust standard errors are clustered at the country level. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 4: Panel Evidence on the Relationship between Undervaluation and Female Labor Force Participation: Fixed Effects With Alternative Real Exchange Rate Measures

	ln *RER* from *PWT* data			ln *RER* from *IMF* data		
	(1)	(2)	(3)	(4)	(5)	(6)
ln *RER*	0.269***	0.284***	0.289***	0.334**	0.249***	0.273**
	(0.053)	(0.044)	(0.060)	(0.135)	(0.090)	(0.103)
ln *initial income* * ln *RER*	-0.036***	-0.037***	-0.038***	-0.037**	-0.028**	-0.031**
	(0.005)	(0.004)	(0.007)	(0.016)	(0.011)	(0.012)
ln *initial income*	0.071***	0.074***	0.076***	0.183**	0.127**	0.138**
	(0.014)	(0.012)	(0.019)	(0.083)	(0.058)	(0.066)
Fertility rate		-0.821	-0.918		1.560	1.502
		(0.780)	(0.801)		(1.029)	(1.180)
Female education		0.001	-0.001		0.004	-0.018
		(0.008)	(0.010)		(0.008)	(0.014)
Male education			0.004			0.023
			(0.009)			(0.015)
Capital stock (as a share of working age population)			-0.012			0.025
			(0.083)			(0.082)
Urban population (as a share of total population)			-0.084			0.084
			(0.102)			(0.076)
Country fixed effects	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes
Observations	991	896	893	458	405	403

Notes: The dependent variable is the average female labor force participation rate measured in 5-year time periods from 1960 to 2015 (Mean: 0.48, Std. dev.: 0.19). Columns 1-3 employ real exchange rate data from Penn World Tables, while columns 4-6 employ real exchange rate data from the *International Financial Statistics* of the IMF. Robust standard errors are clustered at the country level. ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 5: Comparison of Different Country Groups on the Relationship between Undervaluation and Female Labor Force Participation: Fixed Effects

	(1) All countries	(2) Developed countries RGDPPC > $7500	(3) Developing countries RGDPPC < $7500	(4) OECD countries	(5) Non-OECD countries
ln *UNDERVAL*	0.355***	0.034	0.221*	0.099	0.350***
	(0.088)	(0.162)	(0.132)	(0.283)	(0.094)
ln *initial income* * ln *UNDERVAL*	-0.031***	-0.036*	-0.019	-0.094***	-0.031***
	(0.006)	(0.019)	(0.012)	(0.028)	(0.007)
ln *initial income*	0.046***	-0.098**	0.035	-0.017	0.049***
	(0.016)	(0.037)	(0.024)	(0.077)	(0.015)
Fertility rate	-0.896	-1.265	-2.116**	4.027	-1.736*
	(0.804)	(1.226)	(0.884)	(3.346)	(0.897)
Female education	-0.003	0.005	-0.005	0.017	-0.009
	(0.011)	(0.014)	(0.017)	(0.025)	(0.011)
Male education	0.005	-0.003	0.012	-0.005	0.005
	(0.010)	(0.014)	(0.009)	(0.024)	(0.010)
Capital stock (as a share of working age population)	0.024	-0.014	-0.367*	0.132	-0.048
	(0.087)	(0.085)	(0.196)	(0.112)	(0.091)
Urban population (as a share of total population)	-0.057	0.062	0.075	0.330**	-0.042
	(0.103)	(0.070)	(0.167)	(0.126)	(0.089)
Country fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	893	369	524	191	702

Notes: The dependent variable is the average female labor force participation rate measured in 5-year time periods from 1960 to 2015 (Mean: 0.48, Std. dev.: 0.19). Robust standard errors are clustered at the country level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 6: Panel Evidence on the Relationship between Undervaluation and Female Labor Force Participation by Age Group: Fixed Effects

	Dependent variable: Female labor force participation by age group					
	20-24	25-29	30-34	35-39	40-44	45-49
ln *UNDERVAL*	0.253**	0.443***	0.557***	0.564***	0.574***	0.494***
	(0.112)	(0.099)	(0.104)	(0.109)	(0.105)	(0.110)
ln *initial income* * ln *UNDERVAL*	-0.022***	-0.044***	-0.052***	-0.050***	-0.051***	-0.042***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ln *initial income*	0.037**	0.070***	0.081***	0.077***	0.082***	0.067***
	(0.015)	(0.016)	(0.019)	(0.019)	(0.019)	(0.019)
Fertility rate	-2.736***	-2.663**	-2.049*	-1.728	-1.122	-0.238
	(0.952)	(1.033)	(1.102)	(1.068)	(1.049)	(0.984)
Female education	0.010	0.008	0.003	0.001	-0.003	-0.004
	(0.014)	(0.013)	(0.014)	(0.013)	(0.013)	(0.012)
Male education	-0.006	-0.003	0.003	0.005	0.006	0.005
	(0.014)	(0.013)	(0.012)	(0.013)	(0.012)	(0.012)
Capital stock (as a share of working age population)	-0.015	0.124	0.037	0.016	-0.000	0.074
	(0.086)	(0.089)	(0.118)	(0.128)	(0.122)	(0.125)
Urban population (as a share of total population)	-0.082	-0.105	-0.136	-0.148	-0.064	-0.091
	(0.135)	(0.116)	(0.127)	(0.136)	(0.132)	(0.137)
Country fixed effects	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes
Observations	888	889	886	886	888	885

Notes: The dependent variable is female labor force participation rate by different age groups measured in 5-year time periods from 1960 to 2015. Robust standard errors are clustered at the country level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 7: Panel Evidence on the Relationship between Undervaluation and Female Labor Force Participation: Instrumental Variables Estimation

	Dep. var.: Average female labor force participation				
	(1)	(2)	(3)	(4)	(5)
ln *UNDERVAL*	0.889**	0.956**	0.968**	0.998**	0.936**
	(0.428)	(0.457)	(0.462)	(0.480)	(0.476)
ln *initial income* * ln *UNDERVAL*	-0.034*	-0.038*	-0.044**	-0.040**	-0.035*
	(0.019)	(0.021)	(0.021)	(0.020)	(0.020)
ln *initial income*	0.089	0.093	0.072	0.092	0.077
	(0.091)	(0.089)	(0.085)	(0.090)	(0.078)
Fertility rate		-0.601	-0.482	-0.283	-0.858
		(1.180)	(1.306)	(1.310)	(1.200)
Female education			0.011	-0.011	-0.011
			(0.013)	(0.016)	(0.015)
Male education				0.027*	0.025*
				(0.015)	(0.015)
Capital stock (as a share of working age population)					0.125
					(0.123)
Urban population (as a share of total population)					-0.011
					(0.091)
Country fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	620	620	620	620	620
Hansen overidentification test	0.34	0.37	0.17	0.21	0.34

Notes: The dependent variable is the average female labor force participation rate measured in 5-year time periods from 1980 to 2010 (Mean: 0.50, Std. dev.: 0.18). The undervaluation index and its interaction with log of initial income level are instrumented by world capital flows multiplied by the *de jure* (Chinn-Ito) index of capital account liberalization at time t-1, the growth rate of foreign exchange reserves, and the interaction of these two variables with of the log of initial income level. Robust standard errors are clustered at the country level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 8: Panel Evidence on the Relationship between Undervaluation and Male-Female Labor Force Participation Gap: Fixed Effects

Dependent variable: Difference between male-female labor force participation					
	(1)	(2)	(3)	(4)	(5)
ln *UNDERVAL*	-0.148	-0.163*	-0.161*	-0.185*	-0.213**
	(0.090)	(0.091)	(0.095)	(0.096)	(0.103)
ln *initial income* * ln *UNDERVAL*	0.030***	0.032***	0.029***	0.032***	0.037***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.009)
ln *initial income*	0.021	0.020	0.008	0.006	-0.003
	(0.025)	(0.024)	(0.025)	(0.024)	(0.025)
Fertility rate		0.361	-0.063	0.255	-0.434
		(1.001)	(1.062)	(1.059)	(1.143)
Female education			-0.003	0.020	0.020
			(0.010)	(0.015)	(0.015)
Male education				-0.026**	-0.027**
				(0.013)	(0.013)
Capital stock (as a share of working age population)					0.111
					(0.087)
Urban population (as a share of total population)					-0.047
					(0.098)
Country fixed effects	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes
Observations	850	848	752	752	749

Notes: The dependent variable is the difference between male and female labor force participation rates measured in 5-year time periods from 1960 to 2015 (Mean: 0.32, Std. dev.: 0.19). Robust standard errors are clustered at the country level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Table 9: Panel Evidence on the Relationship between Undervaluation and Female Employment Growth by Sector: Fixed Effects

	Female employment growth in:				FLFP	FLFP	FLFP	FLFP
	Manufacturing	Industry	Services	Agriculture	2SLS	2SLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln *UNDERVAL*	0.696**	0.608*	0.347	-0.218				
	(0.317)	(0.344)	(0.410)	(0.642)				
ln *current income*	0.199	0.178	0.249	-0.188				
	(0.145)	(0.145)	(0.225)	(0.285)				
Female employment growth in:								
Manufacturing					0.392*			
					(0.223)			
Industry						0.450**		
						(0.226)		
Services							0.054	
							(0.638)	
Agriculture								0.353
								(0.365)
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	422	420	420	419	411	408	408	407

Notes: The dependent variables in columns 1-4 are female employment growth rate in manufacturing, industry, services, and agriculture, measured in 5-year time periods from 1960 to 2015. The dependent variable in columns 5-8 is the average female labor force participation rate measured in 5-year time periods from 1960 to 2015. Robust standard errors are clustered at the country level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively. Appendix A provides variable descriptions and sources, as well as the list of countries included in the analysis.

Appendix A List of Variables and Countries

Table A1: Description and Sources of Variables

Variable	Description	Source
Female labor force participation, average	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 20-24	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 25-29	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 30-34	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 35-39	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 40-44	in percentage points	Key Indicators of the Labor Market, ILO
Female labor force participation, age 45-49	in percentage points	Key Indicators of the Labor Market, ILO
Male labor force participation, average	in percentage points	Key Indicators of the Labor Market, ILO
Difference between male and female labor force participation	in percentage points	Key Indicators of the Labor Market, ILO
Fertility rate	in percentage points	World Development Indicators, World Bank
Average years of schooling, female age>15 years	in levels	Barro and Lee (2001)
Average years of schooling, male age>15 years	in levels	Barro and Lee (2001)
Capital per working-age person	in percentage points	Bloom et al. (2009)
Urban population (% of total)	in percentage points	World Development Indicators, World Bank
Ln undervaluation index	in percentage points	Constructed from the Penn World Tables 8.1
Ln undervaluation index interacted with ln initial income per person	in percentage points	Constructed from the Penn World Tables 8.1
Ln initial income per person	log, constant 2011 USD	Penn World Tables 8.1
Ln current income per person (based on real GDP)	log, constant 2011 USD	Penn World Tables 8.1
Real GDP per person	constant 2011 USD	Penn World Tables 8.1
Ln real exchange rate, PWT	log, inverse of price level of GDPo	Penn World Tables 8.1
Ln real exchange rate, IMF	log, CPI-based	International Financial Statistics (IFS), IMF
Chinn-Ito capital account openness index	index varying between 0 and 1	Chinn and Ito (2008)
World capital flows interacted with capital account openness index	index varying between -0.6 and 2.6	Chinn and Ito (2008) and IFS, IMF
Foreign exchange reserves in USD (log differenced)	in percentage points	International Financial Statistics (IFS), IMF
Growth rate of female workers in manufacturing	in percent	Key Indicators of the Labor Market, ILO
Growth rate of female workers in industry	in percent	Key Indicators of the Labor Market, ILO
Growth rate of female workers in services	in percent	Key Indicators of the Labor Market, ILO
Growth rate of female workers in agriculture	in percent	Key Indicators of the Labor Market, ILO

Notes: Section 3 provides a detailed discussion of the construction of variables and their sources.

Table A2: List of Countries

Algeria	Chile	Guatemala	Korea	Niger	Swaziland
Argentina	China	Guinea-Bissau	Kuwait	Norway	Sweden
Australia	Colombia	Haiti	Lebanon	Pakistan	Switzerland
Austria	Congo	Honduras	Lesotho	Panama	Syria
Bahrain	Costa Rica	Hungary	Liberia	Peru	Tanzania
Bangladesh	Cyprus	Iceland	Macedonia	Philippines	Thailand
Barbados	Denmark	India	Malawi	Poland	Togo
Belarus	Dominican Republic	Indonesia	Malaysia	Portugal	Trinidad and Tobago
Belgium	Ecuador	Iran	Mali	Qatar	Tunisia
Benin	Egypt	Iraq	Mauritius	Rwanda	Turkey
Bolivia	El Salvador	Ireland	Mexico	Senegal	Uganda
Botswana	Fiji	Israel	Morocco	Sierra Leone	United Kingdom
Brazil	Finland	Italy	Mozambique	Singapore	United States
Burkina Faso	France	Jamaica	Nepal	South Africa	Uruguay
Cameroon	Gambia	Japan	Netherlands	Spain	Venezuela
Canada	Ghana	Jordan	New Zealand	Sri Lanka	Zambia
Central African Republic	Greece	Kenya	Nicaragua	Sudan	Zimbabwe

Notes: The selection of countries is based on data availability.