Macroeconomic Effects of Reducing Gender Wage Inequality in an Export-Oriented, Semi-Industrialized Economy

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Abstract

The paper presents two short-run, structuralist models of an export-oriented, two-sector, semi-industrialized economy in which women workers are concentrated in export production. The first model analyzes the comparative static effects of an exogenous increase in female wages holding male wages and the exchange rate constant. The second model endogenizes the female–male wage ratio and the real exchange rate, assuming flexible nominal wages and a crawling-peg exchange rate. Either stable or unstable dynamics are possible. In the stable cases, a depreciation policy can either close or widen the gender wage gap.

1. Introduction

Until recently, macroeconomic models were constructed as if gender differences were irrelevant for aggregate economic performance. Even today, only a handful of macro models have been developed in which gender differences play any role (Darity, 1995; Ertürk and Çağatay, 1995). This paper presents a macro model of one specific situation in which the gender dimension can be argued to be significant for aggregate economic outcomes: the case of "export-led growth" in semi-industrialized economies (SIEs) in which the export industries rely heavily on low-paid, female labor.

A large literature argues that women's low wages have been a stimulus to growth in many of the most successful cases of export-led development, such as South Korea, Hong Kong, and Taiwan (Deyo, 1989; Hsiung, 1996). Research suggests that the low female wages in these and other countries' export sectors are not explained entirely by women's relatively lower productivity or human capital. Rather, they are largely attributable to gender discrimination embedded in traditional gender norms and social practices combined with women's segregation into export-sector employment and the repression of labor organization by state–corporate alliances (Ward, 1988; Cheng and Hsiung, 1994). These views imply a serious problem for efforts to enhance gender equity in SIEs: if women are able to raise their wages relative to men's, the result could be a decline in export competitiveness and a slowdown in the country's growth rate. In this case, gender equity may not be compatible with growth in an export-oriented SIE.

This paper addresses this set of issues by constructing "structuralist" macro models in the sense of Taylor (1983, 1991): models that assume the "stylized facts" characterizing the main features of a historically specific economic situation and can be used to

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investigate the logical implications of those assumptions for the effects of various types of economic change. The main stylized fact that motivates the present analysis is the gender division of labor that is enforced in the labor markets of many, if not most, developing countries that export manufactures, in which female manufacturing workers face employment barriers that result in their segregation in export-sector jobs at lower wages than male workers receive in domestic industries.[1]

The models developed here build on existing two-sector models of SIEs with "home" and "export" products, and extend them to incorporate gender job segregation and differences in the wages paid to workers in the two sectors. In addition to this gender dimension, other stylized facts that will be reflected in the analysis include the following. First, SIEs are typically dependent on imports of capital goods and intermediate goods and their demand for such imports is price-inelastic. Second, many SIEs have manufacturing sectors characterized by excess capacity and, as a result, their industrial output levels are constrained by effective demand as well as by the availability of necessary imported inputs. Third, domestic manufactures in SIEs are often highly oligopolistic with rigid price–cost margins, while export-oriented manufactures are typically more competitive and have more flexible price–cost margins owing to their need to "price to market" in order to compete in global markets. Fourth, although historically many manufacturing industries in developing countries produced exclusively for export markets, there is increasing production in some of these industries for domestic markets, particularly in middle-income SIEs.

Both of the models developed below are short-run models that take capital stocks and other slowly adjusting variables as given. The first model assumes that nominal wages are rigid for institutional reasons and the exchange rate is fixed, while the second model allows wages to be flexible and also introduces a managed exchange rate regime assuming that the government targets the real exchange rate when nominal wages rise.

2. The Static Model with Rigid Wages and a Fixed Exchange Rate

This section presents a short-run, two-sector macro model of a SIE with gender differences between the workers in the two sectors (home and export goods).[2] This model is used to identify the conditions under which an exogenous rise in female wages has a contractionary or expansionary effect on the outputs of the two goods, and hence on male and female employment, holding male wages and the exchange rate fixed. This specification is motivated by the possible existence of nominal wage rigidities in many SIEs due to factors such as minimum wage laws, union wage bargaining (with long-term contracts), and/or social norms governing gender wage differentials. We also assume here for simplicity that the exchange rate is fixed.

The home product (H) is used for both domestic consumption and investment; for simplicity, it is not exported. It is produced using variable inputs of male labor and imported intermediate goods. The export product (X) is a pure consumption good that is produced primarily for export, but which may also be consumed at home. It is produced by variable inputs of female labor and imported intermediate goods. The price equations for the two goods are

$$P_H = \tau\left(w_m a_H + e P_n^* n_H\right), \quad \tau > 1 \tag{1}$$

$$P_X = \phi\left(w_f a_X + e P_n^* n_X\right), \quad \phi > 1 \tag{2}$$

where τ and ϕ are the price–cost margins (equal to one plus the mark-up rate in each sector); w_m and w_f represent male and female nominal wage rates, respectively; a_i is the labor coefficient in sector i ($i = H, X$); n_i is the intermediate input coefficient in sector i ($i = H, X$); P_n^* is the world price of intermediate inputs; and e is the nominal exchange rate (domestic currency price of foreign exchange). All the input–output coefficients and P_n^* are exogenously fixed, along with both wage rates and the exchange rate. We assume that $w_f < w_m$ for consistency with the stylized facts. Although this does not matter formally to the analysis when wage rates are exogenously fixed, it will matter when we analyze flexible wages in section 4.

The home-sector margin (τ) is assumed to be rigid due to protectionist barriers, government subsidies, and a highly concentrated oligopolistic structure (none of which are modeled explicitly here). The export-sector margin (ϕ) is assumed to be flexible in response to international competitive pressures, and given the intensely competitive nature of the export markets we assume that the price–cost margins adjust instantaneously to try to maintain market shares. The X-sector margin is determined by the following constant-elasticity function:

$$\phi = \Phi \rho_X^{\theta}, \tag{3}$$

where $\rho_X = eP_X^*/P_X$ is the real exchange rate for exports, P_X^* is the foreign currency price of competing products from other countries, $\Phi > 1$ is the domestic firms' "target" profit margin (a constant), and $\theta > 0$ is the elasticity of the price–cost margin with respect to ρ_X.

Essentially, θ is inversely related to the degree of "exchange rate passthrough": the higher the θ, the more domestic exporters squeeze their profit margins in response to a currency appreciation, and the less the appreciation is passed through into export prices. To see this more clearly, (2) and (3) can be combined to yield

$$\phi = \Phi^{1/(1+\theta)} \varepsilon^{\theta/(1+\theta)}, \tag{4}$$

where $\varepsilon = \rho_X \phi = eP_X^*/(w_f a_X + eP_n^* n_X)$ is the ratio of the price of foreign export-competing goods (converted to domestic currency units) to the unit costs (average variable costs) of domestic export goods. The degree of exchange rate passthrough is measured by $1 - [\theta/(1 - \theta)] = 1/(1 - \theta)$; i.e., passthrough is full when $\theta = 0$ and $\phi = \Phi$ is a constant, and approaches zero in the limit as θ approaches infinity and ϕ becomes more and more sensitive to ε.

Nominal national income is divided between total wages, W, and profits, R, assuming for simplicity that there is no government spending or taxation:

$$Y = W + R. \tag{5}$$

Total wages are the sum of the wages earned by each gender in their respective sector:

$$W = w_m a_H H + w_f a_X X, \tag{6}$$

where H and X denote the quantities of output of home and export goods, respectively. Total profits are the sum of the profits received in each sector:

$$R = R_H + R_X, \tag{7}$$

with

$$R_H = (\tau - 1)\left(w_m a_H + eP_n^* n_H\right)H, \tag{8}$$

$$R_X = (\phi - 1)\left(w_f a_X + e P_n^* n_X\right) X. \tag{9}$$

With regard to international trade, the small-country assumption (infinitely elastic demand for a country's exports at a given world price) is not generally valid for SIE exporters because of product differentiation between different SIE suppliers. We therefore assume that good X is an imperfect substitute for competing foreign products, and hence exports of X have a finite (positive) price elasticity ψ:

$$E_X = A\rho_X^\psi, \quad A > 0, \quad 0 < \psi < \infty. \tag{10}$$

The constant term $A > 0$ incorporates foreign income effects on the demand for exports, which are exogenous and can be suppressed for convenience.

Import demand is rigidly tied to domestic production and investment and is completely price-inelastic. Assuming there are no imports of consumption goods, nominal import demand equals the domestic currency value of imports of intermediate goods and capital goods:

$$e P_n^* (n_H H + n_X X) + e P_I^* I_M, \tag{11}$$

where P_I^* is the foreign-currency price of imported investment goods and I_M represents the quantity of imported investment goods. We assume that imported investment goods are a fixed proportion $\mu > 0$ of home investment goods (i.e., $I_M = \mu I_H$),[3] in which case (11) becomes

$$e P_n^* (n_H H + n_X X) + e P_I^* \mu I_H. \tag{11a}$$

Turning to domestic expenditures, we specify functions for private consumption and investment. Assuming that wage and profit recipients have different propensities to spend, and allowing for some domestic consumption of the "export" good, we have four consumption functions.[4] Using C_{ij} for real consumption of good j ($j = H, X$) by income recipients i ($i = W, R$), we have the following expressions for nominal consumption expenditures. For workers:

$$P_H C_{WH} = (1 - \alpha) c_W W, \tag{12}$$

$$P_X C_{WX} = \alpha c_W W, \tag{13}$$

where α is the fraction of their consumption spending on good X. For profit recipients:

$$P_H C_{RH} = (1 - \beta) c_R R, \tag{14}$$

$$P_X C_{RX} = \beta c_R R, \tag{15}$$

where β is the percentage of their spending on good X. Both α and β are assumed to be constant for simplicity. The parameters c_W and c_R are the marginal propensities to consume out of wage and profit income, respectively, assuming $1 \geq c_W > c_R \geq 0$.

Investment expenditures are assumed to be a function of profits in the two sectors (the sectoral destination of the investment is not specified in the model). In the present case, since the total amount of desired investment spending has to cover both domestic and imported investment goods, the investment function is written as follows:

$$e P_I^* I_M + P_H I_H = P_H I_0 + b_1 R_H + b_2 R_X, \tag{16}$$

where the left-hand side is total investment expenditures on both types of investment goods; the right-hand side is the investment demand function, in which I_0 is a constant

term (measured in real terms and reflecting Keynesian "animal spirits"), and b_1, $b_2 > 0$ measure the responsiveness of domestic investment to profits in the two sectors.[5] Using the assumption of a fixed proportion $\mu = I_M/I_H$, (16) can be rewritten in terms of expenditures on home investment goods as follows:

$$P_H I_H = [P_H I_0 + b_1 R_H + b_2 R_X]/(\rho_M \mu + 1), \tag{16a}$$

where $\rho_M = eP_I^*/P_H$ is the real exchange rate for imports of investment goods.

Equilibrium in the two commodity markets is given by the following conditions:

$$H = C_{WH} + C_{RH} + I_H, \tag{17}$$

$$X = C_{WX} + C_{RX} + E_X. \tag{18}$$

The equilibrium condition for overall goods market-clearing (national income equals aggregate demand) can be written in nominal terms as

$$W + R = P_H(C_{WH} + C_{RH}) + P_X(C_{WX} + C_{RX}) + P_H I_H$$
$$+ P_X E_X - eP_n^*(n_H H + n_X X), \tag{19}$$

where imported investment goods have been netted out of both investment demand and imports.

This model can be solved as follows.[6] Given that both sectors are "fix-price" industries,[7] the two key variables that adjust in the short run are the quantities of output H and X; all other endogenous variables (such as W, R, I_H, I_M, and Y) have to be derived as functions of H and X. In order to obtain two independent functions in H and X, we can use any two of the three equations (17) to (19); the third can be derived from the other two. For present purposes, we use the national income identity (19), conceptualized as the saving–investment equilibrium condition (i.e., an "IS curve," although not a traditional one), together with equation (18) for X-sector market-clearing (which we call the "XX curve"). If the market for X clears then the market for H must also clear by Walras' law, so that (17) will also be satisfied.

The IS and XX curves are illustrated in Figure 1. The IS curve slopes down because, if output of either good rises, this creates an excess aggregate supply of goods (excess of saving over investment), and to restore goods-market equilibrium it is necessary for output of the other good to fall, ceteris paribus. That is, the IS curve shows the tradeoff between the quantities of the two goods that can be produced at the same level of aggregate demand; the point along this tradeoff at which the economy operates is then determined by relative demand for the two goods, as reflected in the XX curve. The XX curve slopes up because, if output of H rises, this generates additional wage and profit income, part of which is spent on consumption of X, and hence more X is also produced (assuming that the X-sector does not hit a capacity constraint).[8] There is excess supply in the market for X above and to the left of the XX line, and excess demand below it; there is excess aggregate demand below and to the left of the IS line, and excess aggregate supply above it. The short-run dynamics of the system are as shown in Figure 1 and the equilibrium is a locally stable focus in the neighborhood of the equilibrium point.

3. Comparative Statics of Increased Female Wages

The model developed in the previous section can be used to analyze the comparative static effects of exogenously increasing the female wage rate w_f, holding all other
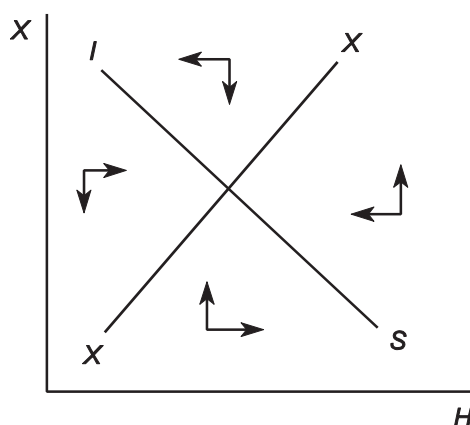
Figure 1. Equilibrium Outputs and Adjustment Dynamics with Rigid Nominal Wages

factors (including the male wage rate w_m) constant.[9] In the context of institutionally rigid wages, this goal might be achieved by raising the minimum wage, or by extending minimum wage guidelines to smaller firms that employ mainly female workers. Alternatively, w_f might increase suddenly as a result of women workers' gains following a successful strike and the negotiation of a new contract, or due to a change in social gender norms that allows women to earn higher wages relative to men.

The comparative static effects of raising w_f operate through three distinct "channels": (1) a relative price effect (the relative price of export goods P_X/P_H increases, and there is a real appreciation or decrease in the real exchange rate $\rho_X = eP_X^*/P_X$); (2) a gender redistribution effect (the women's real wage rises, and the men's real wage falls as long as $\alpha > 0$);[10] and (3) a class redistribution effect (the price–cost margin ϕ is squeezed by higher wages in the X-sector, thus reducing the profit share in that sector). The effects that operate through these three channels then depend on the values of the various parameters in the model, especially: the proportion of wage income spent on export goods (α), the different propensities to consume out of wage and profit income ($c_W > c_R$), the "footloose capital" effect in the investment function (b_2), the price elasticity of export demand (ψ), and the "profit-squeeze" effect on the X-sector price–cost margin (θ).

Table 1 lists the three main possible cases (I through III).[11] In the pessimistic case (I), export markets are very price-competitive (the price elasticity ψ is relatively high) and there is little home consumption of these goods (α is low). The profit squeeze effect, θ, and the footloose capital effect, b_2, are either both high or both low. The XX curve is relatively flat in this case, and a rise in w_f causes both the IS and XX curves to shift downward. Equilibrium output of X (and hence women's employment) definitely falls, while the change in equilibrium output of H (and hence men's employment) is ambiguous. The effects on total employment, $a_X X + a_H H$, and real income, Y/P_H, are ambiguous, but likely to be negative as long as H does not increase too much (and definitely negative if H falls along with X). Essentially, the higher women's wage causes a relatively large loss of export demand that is not offset by a large increase in domestic demand. Consumption does not rise much from the redistribution of income toward wages because c_W is only moderately higher than c_R. A large profit squeeze

Table 1. *Comparative Static Effects of Increasing the Women's Wage Rate*

Case	Description	Parameter values[a]					Effects on output[b]	
		c_W	α	ψ	θ	b_2	H	X
I	Pessimistic	Moderate ($c_W > c_R$)	Low	High, $\gg 1$	High/low[c]	High/low[c]	?	−
II	Cooperative, optimistic	High ($c_W \gg c_R$)	Low	Moderate, but >1	High	Low	+	?
III	Equalizing but conflictive	High ($c_W \gg c_R$)	High	Low, possibly <1	High	Low	?	+

[a] Combinations of parameter values that together are sufficient to make each case occur; no individual parameter value shown by itself is sufficient to make a particular case obtain.

[b] Signs of the partial derivatives, $\partial H/\partial w_f$ and $\partial X/\partial w_f$, respectively. The effects on male employment ($a_H H$) and female employment ($a_x X$) have the same signs as the effects on H and X, respectively.

[c] The combination of *either* a high θ and a high b_2 *or* a low θ and a low b_2, can help to make case I occur.

effect (high θ) causes a steep decline in investment (high b_2); alternatively, a small profit squeeze effect (low θ) results in only a small decrease in investment (low b_2).

Case II assumes that there is a large profit squeeze effect (high θ); the footloose capital effect is small (low b_2); there is a large difference between the propensities to consume out of wages and profits ($c_W \gg c_R$); and export demand is only moderately price-elastic (i.e., ψ is only slightly greater than 1—perhaps because of high-quality export products). In this case, IS shifts up and to the right, since the redistribution of income toward wages boosts aggregate demand by more than the reduction in exports depresses it, while XX shifts downward (assuming α is low), which requires that the increase in domestic consumption of X is not large enough to outweigh the loss of export sales. The equilibrium level of H rises, while the change in equilibrium X is ambiguous. Total employment, $a_X X + a_H H$, and real national income, Y/P_H, are likely to rise, assuming the H sector is larger. Since both genders gain in some respect (women get higher real wages and men get more jobs), we call case II "cooperative" or "optimistic." However, if one thinks that the combination of a relatively high θ with a relatively low ψ is implausible (why should firms flexibly adjust their price–cost margins if higher prices induce relatively little loss of export sales?) then this case may be difficult to achieve.

Case III is similar to II, except that export demand must be relatively price-inelastic ($\psi < 1$) and/or the workers' share of their consumer expenditures on the export good (α) must be relatively large. Then, both XX and IS can shift upward. The equilibrium level of X definitely rises, because of the strong boost in domestic consumption of X and relatively small loss of export sales, while the change in equilibrium H is ambiguous. Total employment, $a_X X + a_H H$, and real national income, Y/P_H, may either rise or fall. Women definitely gain in terms of employment as well as wages; men may either gain or lose jobs, but their real wage definitely falls since they consume significant amounts of the export goods that have risen in price. Because women gain largely at the expense of men, we call this the "equalizing but conflictive" case, but again the combination of a low ψ and high θ may be implausible.

4. Short-Run Dynamics with Flexible Nominal Wages and a Managed Exchange Rate

This section considers a model in which nominal wages adjust endogenously in response to changes in labor market conditions in the short run. Assuming that labor markets are not auction markets, these adjustments are not instantaneous, but rather take place with lags due to institutional factors such as the need to renegotiate contracts. Because the forces that influence female and male wages differ, we model male and female wage rates as distinct endogenous variables that adjust separately in response to conditions in the markets for male and female labor, respectively. However, these two markets are not independent of each other, but rather are linked through various channels embodying household-level gender relations, such as the effect of the level of men's wages on women's labor supply decisions.

Flexible nominal wages influence prices via the mark-up pricing equations (1) and (2), and thus affect real exchange rates. Assuming that governments of SIEs are not indifferent to the resulting changes in export competitiveness, it is also necessary to model adjustments in the nominal exchange rate that can prevent the real exchange rate from getting too far out of line. Historically, most SIEs have either pegged or

managed their exchange rates. One common arrangement is a "crawling peg," in which the nominal exchange rate is fixed at any point in time but is adjusted gradually over time (Williamson, 1981). Although crawling pegs have fallen into disfavor since the Mexican and Asian financial crises of the 1990s, most SIEs continue to manage their exchange rates and a crawling peg will be assumed here as an analytically convenient specification.

The lagged adjustments in nominal wages and exchange rates can be assumed to occur in a relatively short time frame (i.e., periods of one to two years or less), while other variables that adjust in the long run (e.g., capital stocks and technological co-efficients) can be held constant. Thus, we can analyze the short-run dynamics of prices and distribution within a given framework of capital, technology, and institutions. In this analysis, we focus on two ratios that have to stabilize in order to reach a steady-state equilibrium in the short run: the ratio of female to male wages, $\omega = w_f/w_m$, and the real exchange rate for exports, defined previously as $\rho_X = eP_X^*/P_X$.[12]

To facilitate the dynamic analysis, we re-solve the static model from section 2 for the equilibrium levels of H and X as functions of the two state variables, ω and ρ_X, using a simplified version assuming no intermediate imports ($n_H = n_X = 0$).[13] This results in reduced-form solutions that can be written in implicit form as

$$H = H(\rho_X, \quad \omega),\tag{20}$$
$$-/? \quad ?/+$$

$$X = X(\rho_X, \quad \omega),\tag{21}$$
$$+ \quad ?$$

where the likely signs of the partial derivatives are shown underneath the corresponding variables.[14] In the solution for H, there are two alternative cases, with signs separated by slashes beneath equation (20). In one case, a real devaluation is contractionary for home goods production ($H_\rho < 0$), because the redistribution toward profits reduces consumption demand enough to outweigh the increase in export demand, but the effect of a higher relative female wage on home goods production (H_ω) is ambiguous in sign. In the second case, H_ρ is ambiguous in sign because a real devaluation can be either expansionary or mildly contractionary for the H-sector, while H_ω is positive because an increase in the female relative wage ω boosts consumption of the home good. In the X function (21), $X_\rho > 0$ definitely holds because a real depreciation directly increases exports, while X_ω is ambiguous in sign because of the offsetting effects of higher domestic consumption and reduced export competitiveness.

To simplify the dynamics, we continue to take τ, a_X, and a_H as exogenously given, and still assume that the export sector margin (ϕ) adjusts instantaneously to maintain export competitiveness according to (3). Using these assumptions along with the simplifying assumption of no intermediate imports ($n_H = n_X = 0$) in (1) and (2), the domestic relative price P_X/P_H converges to a constant level in the steady state. The dynamics of this model are then described by differentiating the definitions of ω and ρ_X logarithmically with respect to time, which yields

$$\hat{\omega} = \hat{w}_f - \hat{w}_m,\tag{22}$$
$$\hat{\rho}_X = \hat{e} + \hat{P}_X^* - \hat{P}_X,\tag{23}$$

where a circumflex denotes the instantaneous rate of change of the variable. Using (3) and the simplifying assumptions stated above, (23) can be expressed as

$$\hat{\rho}_X = \left[\hat{e} + \hat{P}_X^* - \hat{w}_f\right](1+\theta)^{-1}. \tag{23a}$$

Setting $\hat{P}_X^* = 0$ for convenience, we need only specify adjustment equations for the two nominal wage rates and the nominal exchange rate in order to complete the model.

Nominal wage increases for both women and men workers are assumed to depend on the bargaining power of each *vis-à-vis* their employers. Workers of each gender try to achieve a target level of their real wage by negotiating for increases in their nominal wage; the degree to which they can obtain nominal wage increases is influenced by the tightness of the labor market for each gender. We assume that, owing to social institutions including possible discriminatory practices of firms or governments, women and men not only have different target real wages, but also different abilities to respond to the target–actual wage gaps and labor market tightness.

The two labor markets are assumed to be linked together in two direct ways, reflecting the asymmetrical nature of gender relations in a typical SIE, in addition to the indirect linkages that are implicit in the static model (e.g., consumption demand for each other's products). First, while the men's real wage target is exogenously set (e.g., by the power of male trade unions), the women's target is the men's real wage and they negotiate for nominal wage increases depending on the degree to which their own real wage falls short of the male real wage.[15] Second, since women's market income is often supplementary in male-headed households, female labor supply is modeled as a negative function of the male real wage. As male wages fall, female members of the household may engage in "distress sales" of their labor in order to maintain the family's standard of living.[16] Male labor supply, in contrast, is modeled as exogenous for simplicity.

Reflecting these considerations, the rate of growth of the female wage is determined by

$$\hat{w}_f = \gamma_1\left[(w_m - w_f)/P_C\right] + \gamma_2\left[a_X X - L_f^s(w_m/P_C)\right], \tag{24}$$

where $\gamma_1, \gamma_2 > 0$ are constant parameters reflecting female workers' bargaining power in terms of their ability to respond to labor market conditions;[17] the term multiplying γ_1 is the gap between the target female wage (i.e., the male real wage) and the actual female wage; $P_C = P_H^{(1-\alpha)}P_X^\alpha$ is a consumer price index with geometric expenditure weights $(1 - \alpha)$ and α on H and X goods, respectively; $a_X X$ is the demand for female labor; and $L_f^s(\cdot)$ is the female labor supply, with $L_f^{s\prime} < 0$. Changes in the male wage rate are determined by

$$\hat{w}_m = \delta_1\left[\overline{W}_m - (w_m/P_C)\right] + \delta_2(a_H H - L_m^s), \tag{25}$$

where $\delta_1, \delta_2 > 0$ are constant parameters reflecting male workers' bargaining power; $\overline{W}_m$ is the exogenous target male real wage; $a_H H$ is the demand for male labor; and L_m^s is the exogenously given male labor supply.

The crawling peg policy is modeled by assuming that the monetary authorities adjust the nominal peg continuously in order to keep the real exchange rate for exports from deviating too far from a target level.[18] Thus, the nominal exchange rate is determined by the reaction function

$$\hat{e} = \lambda(\overline{\rho} - \rho_X), \tag{26}$$

where λ is the speed of adjustment and $\overline{\rho}$ is the target real exchange rate.

Substituting (24) to (26) into (22) and (23a), assuming $\hat{P}_X^* = 0$, using the price equations (1) and (2) with $n_H = n_X = 0$, the flexible mark-up rule (3), the definitions of P_C, ω, and ρ_X, and the static solutions (20) and (21), we obtain the following system of equations:

$$\hat{\rho}_X = \{\lambda(\bar{\rho} - \rho_X) - [\gamma_1 (1 - \omega)/\xi(\rho_X, \omega)]$$
$$- \gamma_2 [a_X X(\rho_X, \omega) - (L_f^s/\xi(\rho_X, \omega))]\}(1 + \theta)^{-1}, \tag{27}$$

$$\hat{\omega} = [\gamma_1(1 - \omega)/\xi(\rho_X, \omega)] + \gamma_2 [a_X X(\rho_X, \omega) - (L_f^s/\xi(\rho_X, \omega))]$$
$$- \delta_1 [\overline{W}_m - (1/\xi(\rho_X, \omega))] - \delta_2 [a_H H(\rho_X, \omega) - L_m^s], \tag{28}$$

where $\xi(\rho_X, \omega) = (\tau a_H)^{1-\alpha}(\Phi a_X)^{\alpha}\rho_X^{\theta\alpha}\omega^{\alpha}$ for notational convenience. Equations (27) and (28) can be written in implicit form as (with likely signs of the partial derivatives below the corresponding variables):[19]

$$\hat{\rho}_X = Q(\rho_X, \omega), \tag{27a}$$
$$\phantom{\hat{\rho}_X = Q(} - \quad + $$

$$\hat{\omega} = Z(\rho_X, \omega). \tag{28a}$$
$$\phantom{\hat{\omega} = Z(} ? \quad - $$

Equations (27) and (28) or, equivalently, (27a) and (28a) constitute a system of two simultaneous, nonlinear, first-order differential equations, the solution of which requires linearization around the steady-state equilibrium where $\hat{\rho}_X = \hat{\omega} = 0$, using the method of Taylor expansion. Note that the three variables for which agents have "targets" in equations (24) to (26)—the women's real wage, the men's real wage, and the real exchange rate—will *not* generally be at their target levels in the steady state. Given that labor demand cannot exceed labor supply for either gender, and assuming $\hat{P}_X^* = 0$, a steady-state equilibrium with positive inflation will be characterized by $\hat{e} = \hat{w}_f = \hat{w}_m > 0$ with $\rho_X < \bar{\rho}$, $w_f < w_m$, and $w_m/P_C < \overline{W}_m$. Thus, female workers, male workers, and the monetary authorities will all find their aspirations frustrated, but their efforts to pursue their respective targets will maintain positive cost-push, wage-price inflation with continuous nominal exchange-rate adjustments in the steady state.

Given the signs of the partial derivatives shown in (27a) and (28a), the linear approximation to $\hat{\rho}_X = 0$ must slope upward, but the linear approximation to $\hat{\omega} = 0$ can slope either upward or downward in the neighborhood of the equilibrium, creating three possible cases (labeled A–C and shown in Figures 2–4, respectively). The slope of $\hat{\omega} = 0$ depends on the sign of Z_ρ: if $Z_\rho > 0$, then $\hat{\omega} = 0$ slopes up (cases A and B); if $Z_\rho < 0$, then $\hat{\omega} = 0$ is downward-sloping (case C). The equilibrium is definitely a (locally) stable focus in case C, where $\hat{\omega} = 0$ slopes down, while in cases A and B local stability depends on which of the two upward-sloping isoclines is steeper.[20] In case A, $\hat{\rho}_X = 0$ is steeper than $\hat{\omega} = 0$, and the equilibrium is a (locally) stable node; this case assumes that the crawling peg is adjusted rapidly, a depreciation is expansionary, and the women's labor supply response is relatively weak. In case B, assuming the opposite conditions, $\hat{\omega} = 0$ is steeper than $\hat{\rho}_X = 0$ and the equilibrium is a saddle point.

The saddle-point case B is of particular interest and requires some discussion. The saddle point must be regarded as an unstable equilibrium in this model, since neither ρ_X
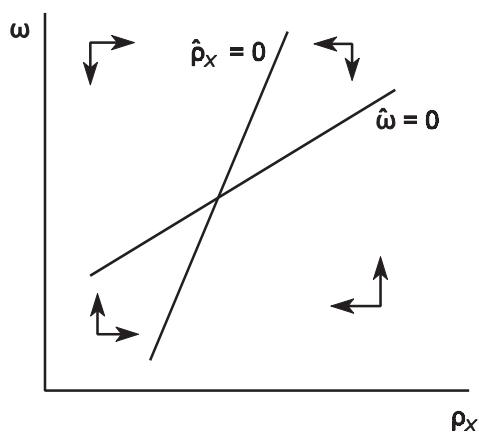
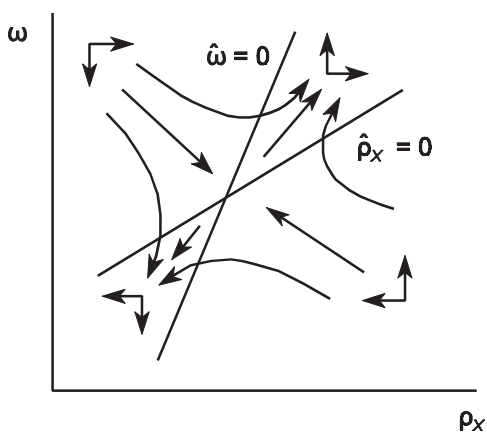*Figure 2. Dynamic Model: Case A—Stable Node Equilibrium*
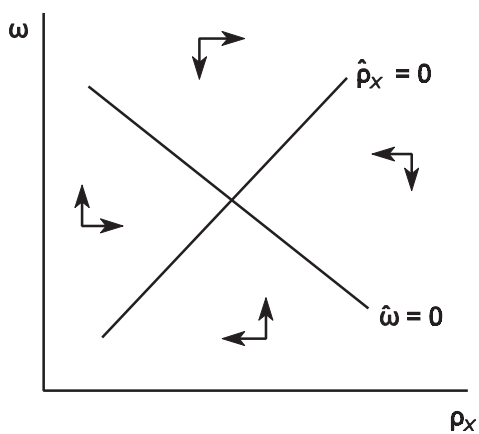

Figure 3. Dynamic Model: Case B—Saddle-Point Equilibrium

Figure 4. Dynamic Model: Case C—Stable Focus Equilibrium

nor ω is a "jump variable" that could be expected to automatically move the economy onto one of the two convergent paths. The instability in this case arises in part from strongly contractionary effects of a devaluation, which imply that as the real exchange rate ρ_X rises, home goods output and male employment fall, and therefore the men's wage falls relative to the women's wage so that ω rises; with women's real wages now closer to their target, women moderate their nominal wage increases, and hence ρ_X rises even further by (27). This case is more likely to occur if there is a strong women's labor supply response, so that as the men's real wage falls (owing to the devaluation) women enter the labor force in large numbers, thereby depressing their own wage increases and making ρ_X rise even faster. This case also requires relatively slow adjustment of the nominal peg (i.e., a relatively low λ), so that the monetary authorities do not act fast enough to appreciate the currency (or slow its rate of depreciation) in nominal terms to offset the moderation in women's wage increases in the export sector.

The unstable paths leading away from the saddle-point equilibrium in Figure 3 have interesting economic interpretations. The paths moving up and to the right represent export-led booms, in which currencies are chronically undervalued and women workers in export sectors are moving in the direction of closing the gender gap[21] owing to tight labor market conditions that enhance their bargaining power. The paths moving down and to the left resemble a Latin American-style balance-of-payments crisis, in which the currency becomes highly overvalued and exports stagnate—and if export-sector workers are mainly women, the gender gap would be expected to rise. An obvious policy remedy for such instability suggested by this model is to increase the speed of adjustment of the exchange rate (λ).

Finally, we examine the comparative dynamics of the model for the two stable cases A and C; the results are summarized in Table 2. First, consider the implications of increased bargaining power for women, made possible for example through improved female education, greater organizing efforts of female workers, or more democratic rights for women. This can be modeled as a rise in γ_1; i.e., a greater ability of women to win nominal wage increases in order to keep their real wages close to their target (i.e., the men's real wage). This causes $\hat{\omega} = 0$ to shift up and $\hat{\rho}_X = 0$ to shift to the left. In case C, the steady-state level of ω definitely rises (the gender gap is reduced) while

Table 2. Comparative Dynamic Results

Increase in:	Case	Shift in: $\hat{\omega} = 0$	Shift in: $\hat{\rho}_X = 0$	Effect on:[a] ω	Effect on:[a] ρ_X
Women's bargaining power (γ_1)	A (Figure 2)	Up	Left	+[b]	−[b]
	C (Figure 4)	Up	Left	+	?
Real exchange rate target ($\bar{\rho}$)	A (Figure 2)	None	Right	+	+
	C (Figure 4)	None	Right	−	+

[a] Signs of the total derivatives of ω and ρ_X with respect to γ_1 and $\bar{\rho}$, in comparisons across steady-state equilibria. See text for discussion of the alternative cases.
[b] See note 22 for the conditions under which these signs result.

the change in the steady-state real exchange rate ρ_X is ambiguous. In case A, the effects on both variables are ambiguous in general, but it is likely that ω rises while ρ_X falls (the real exchange rate appreciates) under plausible conditions.[22]

Second, consider the effects of a devaluation policy, in the sense of an increase in the monetary authority's target real exchange rate $\bar{\rho}$. A rise in $\bar{\rho}$ causes $\hat{\rho}_X = 0$ to shift to the right, with no shift in $\hat{\omega} = 0$. The steady-state real exchange rate definitely rises (i.e., there is a real depreciation), but the effects on the steady-state relative female wage, ω, are ambiguous and depend on the slope of $\hat{\omega} = 0$. If a real depreciation is contractionary for the *H*-sector ($H_\rho < 0$), exports are highly responsive to the exchange rate ($X_\rho >> 0$), and the real wage effects are weak (the $\alpha\theta$ terms in Z_ρ are low), so that $Z_\rho > 0$ and $\hat{\omega} = 0$ slopes up (case A), then equilibrium ω rises (the gender gap is reduced). But if a depreciation is expansionary for home goods ($H_\rho > 0$), the export response is small, and the real wage effects are strong ($\alpha\theta$ terms are high), so that $Z_\rho < 0$ and $\hat{\omega} = 0$ slopes down (case C), then equilibrium ω falls (the gender gap worsens).

Thus, a devaluation policy has ambiguous effects on the gender gap. In spite of the stimulus to export production and women's employment, the female–male wage ratio may either rise or fall depending mainly on how much exports increase (and thus how much women's employment rises), the degree to which the higher exchange rate reduces real wages by increasing the prices of export goods consumed at home, and whether men's employment rises or falls (and hence whether they get a demand-side stimulus to their wages to offset the higher prices of exported consumer goods that otherwise reduce their real wage).

5. Conclusions

The models in this paper shed light on the conditions under which gender equity can be enhanced for female workers in export-oriented SIEs without jeopardizing those countries' growth or sacrificing employment of either men or women. When nominal wages are rigid and the exchange rate is fixed, an exogenous rise in the women's wage rate need not reduce (and may even increase) employment of male or female workers, but only under certain stringent conditions. These conditions include: a relatively low price elasticity of exports; a high elasticity of price–cost margins with respect to international competitive pressures in the export sector; a wide gap between the marginal propensities to consume out of wage and profit income; and relatively large domestic consumption of the export good. If these conditions do not hold, then the fears of the pessimists are likely to be valid, at least in the short run.

When nominal wages are flexible and the exchange rate follows a crawling peg, a variety of short-run dynamic outcomes are possible. In the saddle-point case, it is possible to have an export-led boom in which the gender gap is reduced while the real exchange rate depreciates—or, alternatively, stagnant exports and a rising gender gap with a chronically overvalued exchange rate. In the stable cases, structural changes or policy initiatives are identified that can potentially narrow the gender gap under certain conditions, including a rise in the monetary authority's real exchange rate target and an increase in women's bargaining power. Thus, altering the policy environment and the structure of gender relations can relieve some of the tradeoffs between women's wage gains and export competitiveness that otherwise inhibit a narrowing of the gender wage gap.

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Notes

1. Several factors may contribute to discriminatorily low wages for women, including "crowding" of women into a limited range of jobs and practices such as the "marriage ban" that limits women's job tenure. See Hou (1991), Seguino (1997), and Standing (1989).

2. The modeling approach used here builds on the two-sector framework in Krugman and Taylor (1978), but also borrows features from Blecker (1989, 1996), Dutt (1990), and Taylor (1983). Krugman and Taylor did not allow for domestic consumption of the export good, as we do here.

3. This specification could be rationalized, for example, by assuming that I_M consists of machinery that is not produced domestically in a SIE, while I_H consists of factory buildings produced by domestic labor with imported intermediate goods.

4. We do not distinguish saving and consumption behavior by gender because there is less clear evidence on how women and men differ in this regard.

5. The coefficient b_2 reflects the openness of a country to inflows and outflows of "footloose capital," which makes investment in any particular SIE responsive to the relative profitability of its export production compared with that of other SIEs.

6. The mathematical solution of this model is outlined in an appendix, which is available from the authors on request.

7. Although there is a flexible price–cost margin in the X-sector, this does not generally imply that P_X is flexible enough to clear the market for X without quantity adjustments by producers.

8. This effect would not be present if there were no home consumption of X ($\alpha = \beta = 0$), in which case output of X would be determined solely by supply-and-demand conditions in the export market independently of H production, and the XX curve would be a horizontal line.

9. We give an intuitive presentation of the comparative statics here; the mathematics underlying the results are discussed in the unpublished appendix.

10. This assumes that the men's nominal wage stays fixed, which implies that the price of home consumption goods P_H also stays fixed, so that even if women workers buy a combination of home and exported goods their real wage necessarily rises. Also, note that the price of exported goods, P_X, rises less than proportionally to the rise in the women's wage, w_f, owing to the "profit squeeze" effect in equation (3). Male workers lose as long as they buy any export goods.

11. Logically, there is a fourth possible case, in which XX shifts up while IS shifts down. We cannot think of a plausible combination of parameter values in which this would occur.

12. The adjustments in the real exchange rate for imports of investment goods, ρ_M, are linearly dependent on the adjustments in ρ_X and ω, and hence do not have to be modeled separately. To see this, note that since $\hat{\rho}_M = (1 + \theta)\hat{\rho}_X + \hat{\omega}$, ρ_M will be stationary when $\hat{\rho}_X = \hat{\omega} = 0$, assuming for convenience that both foreign goods prices (P_I^* and P_X^*) are constant.

13. This simplification is intended to focus on the dynamics of labor costs in relation to export competitiveness, but may affect the results insofar as it eliminates the effect of currency depreciation in increasing costs of imported intermediate goods.

14. For mathematical details on the simplified static model, see the unpublished appendix.

15. Women may target real male wages because they view men's wage payments as non-discriminatory, and hence as a benchmark for their own wage aspirations, or else because they consider gender wage equality as an objective to be pursued. Alternatively, women's wages could be modeled as a function of female wages in export sectors in other SIEs. While foreign female wages are not modeled explicitly here, they do influence domestic women's wages indirectly insofar as they affect foreign competing export prices (P_X^*) and the real exchange rate ρ_X.

16. This negative effect of the male wage on female labor supply will be weaker in situations where women workers are more independent, such as in female-headed households or in the case of daughters who have migrated to urban areas and are living on their own.

17. Factors that affect women's bargaining power may also include discriminatory behavior or gender stereotyping by employers, which may deny women greater access to a wide array of jobs. Also, if women have less access to secondary and higher education this may limit their employment options and hence reduce their bargaining power.

18. The assumption of a real exchange rate target used here is similar to Aghevli (1981).

19. The signs of these partial derivatives are analyzed in the unpublished appendix.

20. Formally, considering the Jacobian matrix of the system (27a) and (28a), the local stability condition is a negative trace ($Q_\rho + Z_\omega < 0$) and a positive determinant ($Q_\rho Z_\omega - Z_\rho Q_\omega > 0$). The saddle point occurs when $Q_\rho Z_\omega - Z_\rho Q_\omega < 0$, which is equivalent to $\hat{\omega} = 0$ being steeper.

21. Although it looks like ω increases indefinitely on the upward paths in Figure 3, and thus ω could reach or even exceed unity (thus eliminating or reversing the gender gap), this figure represents only the local dynamics in the neighborhood of an equilibrium with $\omega < 1$, and hence all we can say is that ω is rising but not whether or not it will reach or exceed unity.

22. The condition for equilibrium ω to rise in case A, in which $Z_\rho > 0$, is $Z_\rho > -(1 + \theta)Q_\rho$, which can be interpreted as implying that a devaluation must not be excessively contractionary; i.e., H_ρ must not be too negative (although $H_\rho < 0$ must hold in order for $Z_\rho > 0$). The condition for equilibrium ρ_X to fall is $Q_\omega < -Z_\omega/(1 + \theta)$; this same condition applies in both cases A and C.