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Measuring the Effect of Gender-Based Policies on Economic Growth

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To this day, policy makers, policy advisers, and economists in development institutions do not have any practical tools to help them to assess the impacts of policies aimed at promoting gender equality and quantify the effect of these policies on growth. Yet, there has been limited effort in that direction. This note lays out such a tool,[1] a framework for quantifying the growth effects of gender-based policies in developing economies, developed recently in the context of a research project sponsored by the World Bank. The framework is based on analysis using a computable overlapping generations model that accounts for the impact of access to infrastructure on women's time allocation, as well as human capital accumulation and inter- and intragenerational health externalities. The analysis also presents illustrative gender-based experiments in a calibrated version for a low-income country (Benin).

The role of women in economic development continues to occupy center stage in policy debates. As documented in a number of studies, including the recent World Development Report 2012 by the World Bank (2011), gender inequality—in terms of access to education, health, formal sector employment, and income—remains a significant constraint to growth in many countries. Although the gender gap in primary school enrollment has pretty much disappeared in many countries, progress toward gender equality in secondary schooling has been slower. In some regions, particularly in sub-Saharan Africa, secondary enrollment gaps have widened.

In today's low- and middle-income countries, the labor force participation rate for women remains low, and in most regions, female employment remains concentrated in either services or agriculture. Large pay differentials continue to prevail between men and women; according to data compiled by UN WOMEN (2011), the gender pay gap ranges from 3 to 51 percent, with a global average of 17 percent. Seven out of ten of the world's poor are women or girls. In this context, it is important for policy makers, policy advisers, and economists to have tools to measure the impacts of policies targeted at promoting gender equality and be able to quantify the effect of these policies on growth.

The Framework: A Gender-Based OLG Model

To study the interactions between gender and growth, the framework employs a gender-based overlapping generations (OLG) model of economic growth that accounts endogenously for women's time allocation between home production, child rearing, and market work.[2] The model is rich enough to provide, once quantified, a serious starting point for policy analysis. The key building blocks of the model in-

clude home production; families; market production; schooling and human capital; health and productivity; the government's budget; and women's bargaining power.

Home production

The starting point of the model is an economy where two goods are produced, a marketed good and a home good. The marketed good can be either consumed today or stored to yield capital tomorrow. Home production (which includes cooking dinner, doing laundry, cleaning the house, and similar tasks) positively affects the family's utility and involves combining women's time allocated to that activity with infrastructure services (figure 1).

Families

Individuals live for (at most) three periods: childhood, adulthood, and retirement. At the beginning of the first period of life and the end of the second, there is a nonzero probability of dying. Each individual is either male or female, and is endowed with one unit of time in childhood and adulthood, and zero units in old age. Families consist of two parents (one male, one female) and children. Schooling in childhood is mandatory and a full-time activity, so children devote all their time to education. They depend on their parents for consumption and any spending associated with schooling and health care.

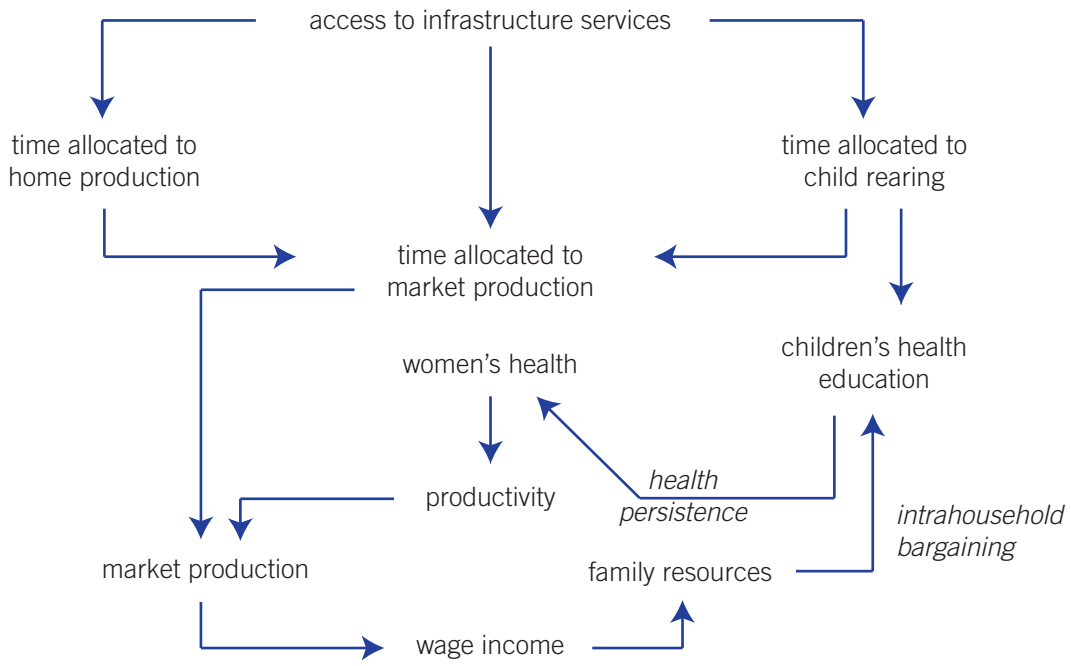
In adulthood, individuals enter randomly into matches with an individual of the opposite sex to form a family. Once married, individuals do not divorce; couples retire together (if they survive to old age) and die together. Each couple produces n children. Parents raising a child face two types of costs. First, the child's mother must spend time with each of them—which becomes an opportunity cost. Second, raising children involves direct costs in terms of marketed goods, measured in terms of a fraction of the family's net income. This cost is related to sending children to school and taking care of their health needs. Fathers and mothers have different preferences in terms of consumption and the health of children; fathers have a relatively higher preference for current consumption, whereas mothers have a higher preference for children's health. However, despite these differences, all income is pooled and couples are joint decision makers. Importantly, the familywide preference parameters for consumption and children's health depend on women's bargaining power.

All middle-aged males and females work; the only source of income therefore is wages in the second period of life. Male spouses are not involved at all in child rearing and inelastically allocate all their time to market work. By contrast, female spouses must consider three alternatives: market work, raising children, and home production (which includes time spent collecting water and firewood, for example). At a formal level, women choose only child rearing and home production; the overall time constraint that they face implies that time allocated to market activity is determined residually (figure 1).

Market production

Producing market goods requires private capital, male effective labor (obtained by multiplying male productivity by the

Figure 1. Infrastructure and Women's Time Allocation



Source: Authors' illustration.

number of adult male workers and male human capital, given that all male time is allocated to work), female effective labor (obtained by multiplying female productivity by the number of adult female workers, female human capital, and the amount of time women allocate to market work), and public infrastructure. Although infrastructure is nonexcludable, it is partially rival because of congestion effects. The gender gap in the workplace is captured by assuming that women earn only a fraction of their marginal product. All else being equal, the smaller that fraction, the larger the effective wage differential is between men and women.

Schooling and human capital

As noted earlier, schooling is mandatory, so children allocate all of their time to education. Boys and girls have identical innate abilities and have access to the same out-of-home learning technology. In addition to children's time, the production of either type of human capital requires several other inputs. First, it depends on the time that mothers allocate to tutoring their children at home. A sequential process is considered, whereby mothers determine first the total amount of time allocated to child rearing, and then subdivide that time into a fraction $0 < \alpha < 1$ allocated to sons and the rest, $1 - \alpha$, allocated to daughters. A bias in parental preferences toward boys can therefore be captured in a simple manner by assuming that the fraction of time allocated to them, α, exceeds 0.5. As it turns out, this parameter also plays a critical role in determining women's bargaining power.

Second, the production of human capital depends on access to public infrastructure. This variable captures the importance of infrastructure for education outcomes (Agénor 2012b). Third, knowledge accumulation depends on government spending on education per child. Fourth, and in line with the empirical evidence (Blackden et al. 2006), human capital accumulation depends on the mother's human capital. Under standard assumptions, the model implies that the male–female human capital ratio depends positively on the ratio $\alpha / (1 - \alpha)$, the relative time allocated by mothers to boys. Thus, if $\alpha > 0.5$, a boy's human capital in adulthood will exceed systematically a girl's human capital when she grows up—solely as a result of the greater time allocated by mothers to rearing their sons. Therefore, differences in economic outcomes between men and women are fundamentally related to the gender bias experienced in the home during childhood.

Health status and productivity

Health status in childhood depends on (i) the mother's health, (ii) the effective amount of time allocated by the child's mother to child rearing, and (iii) the provision of health services by the government. The health status of both males and females in adulthood is determined by health status in childhood and the relative level of women's human capital. The first statement above is consistent with the evidence that early childhood health affects cognitive and physical development, which in turn has a large impact on health outcomes later in life.[3] The second statement captures the fact that when women are relatively more educated, it benefits not only their own health (presumably because they are more aware of women's health risks), but also the health of their husbands—possibly by increasing awareness in the family about health risks, improving the diet of all members of the household, and so on. In addition, if more educated women are healthier, they also and end up taking better care of their children.[4] The magnitude of these externalities plays an important role in some of the gender-based experiments reported later in this note.

Adult productivity is positively related to health status. The model shows that if $\alpha > 0.5$, a boy's health in childhood, and productivity in adulthood, will exceed systematically a girl's health and productivity in midlife, again, solely as a consequence of bias toward boys in their mothers' time allocation.

Government budget

The government invests in infrastructure and spends on education, health, and some unproductive (or, rather, not directly productive) items. Shares of spending are all taken to be constant fractions of government revenues. These revenues, in turn, consist only of taxes on the wage income of adults, both males and females. All public services are provided free of charge to firms and families. The government cannot borrow and therefore must run a balanced budget in each period.

The government also produces health services by combining public capital in infrastructure and the flow of spending on health. Thus, access to infrastructure is essential to the production of health services.[5] With full depreciation for simplicity, the stock of public capital in infrastructure at the beginning of any period is simply equal to the flow of investment in the previous period. However, investment in infrastructure, as well as spending on health and education, is inefficient—only a fraction of these flows is actually converted into public capital (in the first case) and effectively (in the second and third cases) enhances the production of health and education services.

Women's bargaining power

An important feature of the model is the bargaining power of women, which is assumed to depend on the relative levels of human capital of husband and wife. The model implies that in equilibrium, women's bargaining power depends fundamentally on a key structural parameter: the allocation of mothers' time to their sons and daughters, as measured by α. The stronger the bias toward boys in childhood (the higher α is), the lower the human capital women eventually accumulate, and the weaker their bargaining position is later in life. In that sense, inequality in the family (possibly the consequence of social norms) translates into inequality in the workplace.

The model also suggests that greater bargaining power for women leads to a higher savings rate for the family as a whole. The reason is that, as noted earlier, men and women have different preferences in terms of current consumption and preferences for children's health: men value consumption in adulthood more, whereas women value children's health more. Because the familywide preference parameters in both cases depend on women's bargaining power, a change in that parameter changes the (weighted) averages as well. In particular, an increase in women's bargaining power lowers the preference for current consumption (which promotes savings) and increases the relative preference of the family for children's health. In addition, the average survival probability also tends to increase, which in turn promotes savings.

Model solution

The solution of the family's optimization problem yields equilibrium values for women's time allocation and the fertility rate. A key relationship is the inverse link between time allocated to home production and access to infrastructure; it implies that both time allocated to market work and time allocated to child rearing (which are both productive in this setting) are positively related to access to public capital.

The solution of the complete model (accounting for human and physical capital accumulation, both public and private) leads to an explicit expression for the economy's long-run growth rate, which depends on the long-run value of the public–private capital ratio and the health status of adult females, as well as women's time allocation parameters. Both the male–female health status ratio and the male–female human capital ratio are constant and depend positively on women's time allocation for child rearing parameter, α. These static, long-run relationships are then calibrated and simulated.

Calibration Methodology

To illustrate possible outcomes and examine the impact of public policy, the model is calibrated for a low-income country, Benin.[6] Calibration uses four sources for information:

(i) Literature on applied OLG models, which although limited, provides some guidance for a few parameters (for example, the household discount rate).

(ii) Various econometric or quantitative studies for developing countries that provide evidence on production elasticities and spending efficiency parameters.[7]

(iii) Direct country data from a variety of sources—including the World Bank, the International Monetary Fund, and the United Nations.

(iv) Indirect country data, that is, information relating to those parameters that are obtained by directly transforming available raw data. For instance, the bargaining power of women is set at 0.34. This corresponds to the relative literacy rate of adult females (ages 15 and above) for Benin in 2008, as given in the World Development Indicators Database, divided by the sum of the literacy rates for males and females, that is, 28.1 ÷ (28.1 + 53.5). The idea is that this ratio provides a good proxy for the relative human capital of women.

Based on the information collected from all these sources, a final set of parameters is derived by induction, to ensure that all formulas (and composite parameters) in the model hold as they appear in the reduced-form expressions for women's time allocation, female health status, the public–private capital ratio, and the long-run growth rate of the economy.

The result of the calibration exercise shows that in the benchmark case, the initial public–private capital ratio is 0.28 and that women allocate 30 percent of their time to home production, 28.7 percent to child rearing, and 41.3 percent to market work.

Gender-Based Policy Experiments

To illustrate the role of gender-based public policy in the model, three experiments were conducted: a reduction in the cost of child rearing, a reduction in gender bias in the market place, and an increase in women's bargaining power.

Reduction in the cost of child rearing

Suppose that the government implements measures (free medical supplies, free access to schools, and so forth) that lead to a drop in the unit cost of child rearing for the family. These measures are assumed to result from a reallocation among unproductive components of spending, so that shares of all broad spending components remain constant. Thus, the policy shift is budget neutral and can be considered in isolation from other changes.

A drop in the cost of child rearing raises the gross fertility rate in the exact same proportion. Thus, the total cost of rearing children does not change. By implication, the public–private capital ratio does not change either. In addition, the amount of time spent by women in home production and in market work remains the same. To ensure that the time constraint holds, time allocated to rearing each (surviving) child must fall, to ensure that total rearing time remains constant. Indeed, the results indicate that time allocated to each child drops from an initial value of 0.067 to about 0.05. There is therefore a substitution of "quantity" for "quality." Although the reduction in child-rearing costs tends to promote growth (by raising private savings), the fall in time allocated to each child tends to hamper it, because it has an adverse effect on children's health, which eventually affects their productivity in adulthood. If the latter effect is not too strong, growth increases—in this analysis by 0.2 percentage points on an annual basis, with the benchmark set of parameters.

Reduction in gender bias in the market place

Suppose that the government introduces antidiscrimination laws that lead to a permanent reduction in gender bias against

women in the workplace. All else being equal, women's take-home pay increases.

The direct effect of this policy (at the initial level of wages) is to raise family income. In turn, higher income leads to a higher level of private savings and private capital stock, which has a direct positive effect on growth and increases tax revenues, which promotes spending on health and education. Women's time allocation and the fertility rate are not affected. And because changes in the degree of gender bias in the workplace affect tax revenues and private savings in exactly the same way, the public–private capital ratio is not affected either. But because higher tax revenues lead to higher public spending on health, there is a positive effect on health in childhood and female health in adulthood. Thus, once all these effects have played out, a reduction in gender bias leads to an increase in the growth rate of output and improved health outcomes.

Increase in women's bargaining power

Finally, consider an autonomous increase in women's bargaining power (unrelated to mothers' time allocation between boys and girls), from an initial value of 0.34 to 0.5, that is, parity between men and women. Such an increase is not easy to accomplish of course, but the experiment serves a good illustrative purpose.

In the model, there are two main channels through which this shift affects growth. First, because women's preference for current consumption is lower than men's, it reduces the average family preference parameter for today's consumption. As a result, families increase their savings. At the aggregate level, the increase in savings translates into a higher private capital stock in the steady state. Second, because women's preference for children's health is higher than men's, it increases the average family preference parameter for children's health.

Both of these channels have important effects on growth. The increase in private capital stock has a direct, beneficial impact on growth. But at the same time, it tends to reduce the public–private capital stock (through a congestion effect), thereby exerting an indirect, negative impact on long-run growth. In addition, the drop in the public–private capital stock has an adverse effect on human capital accumulation and on health status in childhood and adulthood through the supply of health services. The magnitude of this "human capital effect" depends in particular on the degree of persistence in health and the elasticity of labor productivity with respect to health status in adulthood.

An increase in women's bargaining power also affects women's time allocation. Higher family preference for children's health means that mothers end up allocating more time to child rearing; this reallocation is productive because it helps improve children's health and education outcomes, and thus their productivity in adulthood, and therefore is beneficial for growth. However, this reallocation occurs partly to the detriment of women's time allocated to market work, which falls slightly in the base experiment; this tends to have an adverse effect on growth. Accounting for these various effects, in the benchmark calibration, the net effect of the increase in women's bargaining power on growth is slightly positive.

The lessons from this experiment are quite important. When trying to assess the growth effects of an increase in women's bargaining power, it is important to distinguish between benefits at the microeconomic (or family) level and at the macroeconomic (aggregate) level. At the microlevel, the increase in women's bargaining power benefits children, because it implies that the family's overall preference parameter tends to increase and leads to a time reallocation toward child rearing. At the same time, the lower family preference for present consumption leads to higher savings. At the aggregate level, however, the increased investment associated with higher savings has conflicting effects on the economy's production capacity—a direct effect, which is positive, and an indirect effect, related to congestion of public capital, which is negative—whereas more time spent taking care of children means less time in market work. Unless the benefits of mothers spending more time with their children are large (in terms of improved health and education outcomes in childhood and greater productivity in adulthood), the net effect on growth may not be very significant.

Concluding Remarks

The framework introduced in this note can be used as a practical tool for assessing the impact of gender-based policies on growth and human development. Although the model used is of a relatively small scale, it is detailed enough to provide a serious starting point for studying the impact of these policies, as well as a variety of others, especially policies affecting public expenditure allocation.[8]

The approach proposed here is to calibrate the steady-state solution of the model (which is static in nature) and focus on the long-run effects of public policies, because many of these policies are structural in nature and likely to produce tangible economic results only over a period of several years. Because the model is based on rigorous microfoundations and possesses well-defined, long-run properties, the effects of public policies (on the economy's growth rate, for instance, or on women's time allocation) are calculated on the basis of precise expressions, which can be computed relatively easily using standard software.

The requirement of tractability and the need to derive closed-form solutions inevitably impose restrictions on the type of functional forms (for utility, production functions, and so forth) that can be used. However, using more general functional forms means that analyzing the model's properties would require a full-blown numerical analysis. The need to

use more advanced software for solution purposes may well hamper its use for operational purposes. These trade-offs cannot be ignored, especially given the fact that the evidence underlying the motivation for using more complex functional forms may not be robust or consistent across countries.

Thus, while the model described here may not provide complete versatility, it does represent a significant step forward in an area where there is a dearth of quantitative tools available for policy analysis. Indeed, by focusing on steady-state effects, and by allowing an explicit analytical characterization of the long-run equilibrium, the framework provides a rigorous yet practical tool that may help to systematically integrate more interaction between structural policies, gender, and growth in operational work conducted at the World Bank and other development institutions.

In a sense, "mainstreaming" gender and growth issues in policy circles is a two-step process: the first step involves using a relatively simple but rigorous and transparent framework, such as the framework proposed in this note, to encourage practitioners to pay systematic attention to this important dimension of development; the second step involves using more advanced dynamic models—which could build on the present framework—when sufficient practical experience has been acquired.

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Notes

1. This note draws largely on Agénor (2012a) and Agénor and Canuto (2012).
2. The model is described in detail in Agénor (2012a) and Agénor and Canuto (2012). For a brief review of the literature on gender-based OLG growth models, see also Agénor, Canuto, and Pereira da Silva (2010).
3. See Agénor (2009) and the references therein.
4. See Agénor (2012b, chapter 5) for a review of the evidence.
5. See Agénor (2012b, chapter 3) for a detailed review of the evidence.
6. Another country application, based on the same quantitative framework, is being developed by the World Bank for Burundi (Nganou 2012).
7. For example, for data on investment efficiency, see the study by Dabla-Norris et al. (2011).
8. Other policies (including changes in spending for infrastructure investment) are discussed in Agénor (2012a) and Agénor and Canuto (2012).

References

Agénor, Pierre-Richard. 2009. "Public Capital, Health Persistence and Poverty Traps." Working Paper No. 115, Centre for Growth and Business Cycle Research, University of Manchester.

——. 2012a. "A Computable OLG Model for Gender and Growth Policy Analysis." Unpublished, University of Manchester and World Bank.

——. 2012b. *Public Capital, Growth, and Welfare*. Princeton, NJ: Princeton University Press.

Agénor, Pierre-Richard, and Otaviano Canuto. 2012. "Access to Infrastructure and Women's Time Allocation: Evidence and a Framework for Policy Analysis." Policy Paper No. 45, FERDI, April. http://www.ferdi.fr/Documents-de-travail.html

Agénor, Pierre-Richard, Otaviano Canuto, and Luiz Pereira da Silva. 2010. "On Gender and Growth: The Role of Intergenerational Health Externalities and Women's Occupational Constraints." World Bank Policy Research Working Paper Series No. 5492, Washington, DC, revised March 2012, University of Manchester and World Bank. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1721330

Blackden, C. Mark, Sudharshan Canagarajah, Stephan Klasen, and David Lawson. 2006. "Gender and Growth in Sub-Saharan Africa: Issues and Evidence." Research Paper No. 2006/37, UNU-Wider.

Dabla-Norris, Era, Jim Brumby, Annette Kyobe, Zac Mills, and Chris Papageorgiou. 2011. "Investing in Public Investment: An Index of Public Investment Efficiency." Working Paper No.11/37, International Monetary Fund.

Nganou, Jean-Pascal. 2012. "Public Expenditure, Gender-Based Policies and Growth in Burundi: A Quantitative Analysis." Unpublished, World Bank.

UN WOMEN. 2011. *Progress of the World's Women 2011–2012: In Pursuit of Justice*. New York: United Nations.

World Bank. 2011. *World Development Report 2012: Gender Equality and Development*. Washington, DC.

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