A Model of Gendered Production in Colonial Africa and Implications for Development in the Post-Colonial Period

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Abstract

This paper proposes a model to analyze the implications of colonial policies for gender inequality in Sub-Saharan Africa. The model emphasizes segmentation of production under complete specialization. It shows that the colonial production model, underpinned by occupational job segregation in the agricultural sector and gender bias in the non-agricultural sector, exacerbated gender inequality by limiting employment

opportunities for women outside the realm of home production and subsistence agriculture. Over the past few decades, the resilience of parameters underlying these models of colonial production has heightened the risks of macroeconomic volatility in the region, especially where the structural transformation from low to high-value-added activities has remained elusive.

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A Model of Gendered Production in Colonial Africa and Implications for Development in the Post-Colonial Period¹

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“Cotton growing could not be left to the women and old people.”
—European Director of Agriculture in Uganda (1923).

I Introduction

The majority of models which have been used to investigate the dynamics of gender relations with respect to economic activities in Sub-Saharan Africa have seldom integrated the colonial dimension of production, even though colonial policies had a profound and transformational impact on the nature of gender relations and their interaction with production in the region [Tibaijuka (1994), Darity (1995), Warner (2000)]. In practice, the partial approach to gender analysis underpinning these models of gender production has come with a cost. In particular, it has made it difficult to assess the incidence of colonial policies on the dynamics of gender production and women's economic empowerment from a unified analytical framework.

At the same time, of the very few studies which have attempted to model the colonial economies of Sub-Saharan Africa, not many have taken into account the gender dimension of production [Lewis (1954), Hansen (1979), Rodney (1982)]. The majority of these studies has drawn on unitary models, which for convenience, treat the household as a single decision making economic agent, with a single budget constraint and maximizing a single utility function in which each household member's consumption enters as an argument [Haddad et al. (1997)].² In addition, these models assume that intra-household distribution of resources is Pareto-efficient, with each household member maximizing its utility under Pareto optimal allocation [Browning et al. (2004)].

Of course, most of these assumptions are completely divorced from the African colonial and post-colonial non-cooperative setting where exploitative bargaining advantages either attributed to traditional norms, to colonial policies or to both (as they tend to be mutually-reinforcing)³ are more likely to lead to sub-optimal utility for individual members and to a non-Pareto optimal outcome for the household [Brydon and Chant (1989)].⁴ Reflecting this viewpoint, Sen (1987) defined the relationship at the household level as one of co-operative conflicts, in which husband and wife gain from cooperating with one another in a joint living arrangement so far as it increases the capability of the household as a whole.

This paper attempts to fill the analytical gaps created by the partial analysis of gender dynamics in Sub-Saharan Africa. It sheds some light on African economic history and on the dynamics of gender production during the colonial period using a model that takes into account interdependent, asymmetric power relations for husband and wife. More specifically, it draws on a modified version of the standard Ricardian framework to propose a model of gender production that takes into account the colonial dimensions of production and the implications of colonial policies for factor allocation and gender production at the household level.

² Though alternative models have been proposed in recent years, including axiomatic bargaining models (Manser and Brown (1980)) and non-cooperative models (Lundberg and Pollak (1994)), unitary frameworks continue to be widely drawn upon to model household production and distribution of resources.

³ In effect, to the extent that the dynamics of gender relations with respect to household production and distribution of resources is influenced by both, traditional norms and colonial constructs, women's menu of choices concerning productive and allocative decisions are likely to be shaped by both colonial policies and their husband decisions.

⁴ A number of criticisms have been expressed against unitary models: on theoretical grounds, the inability of these models to account for intra-household inequality and for addressing household formation and dissolution; on the empirical ground, predictions from these models have not always been consistently supported by the data [Rode (2011)].

In addition to enhancing understanding of gender production in the colonial period, the proposed framework also has the potential for discerning the parameters driving gender inequality in the post-colonial period. In effect, aggregate output in most countries in the region is still governed by the production parameters established by the colonial administration. The continued connection of African countries to the global economy as primary agricultural commodity and natural resource exporters is a perfect illustration [Hansen (1979)]. Similarly, the persistent dichotomy between subsistence and export crops—a reflection of continued weak forward and backward linkages in production processes—is also part of the colonial legacy.⁵

At the same time, the resilience of parameters underlying the colonial economy had adverse effects on welfare and macroeconomic stability in the post-colonial period. The continued reliance on primary commodities in the post-colonial period has heightened the risk of recurrent current account deficits in the region, resulting in sustained increases in the scope of external liabilities. Moreover, it has also stifled opportunities for labor-intensive industries and productivity growth with disproportionate adverse effects on women, most of whom have remained largely confined either to subsistence agricultural production or increasingly to the informal sector, as a consequence of gender bias in the formal sector outside subsistence agriculture [Boserup (1970), Charmes (2000)].

Still, women's path to economic empowerment is also hampered by gender constructs and cultural norms, most notably the competing demands on their time that are invariably, elastically allocated between home production of final consumption goods, subsistence agricultural production and child rearing. Men, in contrast, have continued to enjoy a higher degree of specialization that is consistent with policies governing production in colonial Africa. They inelastically allocate their time to commodity exports and resource extraction activities, which benefit from access to global technology by virtue of their status of chartered companies, colonial enterprises or more recently, multinational companies.

The proposed analytical framework takes into account these gender-differentiated constraints to production. In addition, it emphasizes agricultural production and resource extraction that are the main drivers of output and GDP growth in Africa, both during the colonial and post-colonial period. The African colonial economy is also characterized by the surplus of land. Local governments have a limited role in the production and accumulation process.⁶ The administration is controlled from the colonial empire and pursues economic policies that are primarily in the interest of the imperial power [Hansen (1979)]. Reflecting this setting, product prices are given from abroad under the proposed analytical framework.⁷

The rest of the paper is organized as follows: Section II offers a review of the dynamics of gender relations as it relates to production during colonial times. In particular, it highlights the sexual division of labor in subsistence agriculture and gender bias in other spheres of production. Section III proposes a model of gender production in colonial Africa. The model is based on an extension

⁵ Colonial constructs encompass assumptions and positions of imperial powers that gained force or reality in the colonial setting through policies and institutions. A classic example was the colonial assumption that African societies were patriarchal like European societies and that women were subordinate with no political role [Saidi (2010)]. Constructs were artificial or reifications that gained significant force through operationalization.

⁶ However, this assumption on the limited role of governments can be relaxed in the post-colonial period to account for interventionist policies adopted by a number of governments in the early years of independence.

⁷ These assumptions can also be extended to the post-colonial period where small economies are price takers in an open economy setting.

of the Ricardian framework to take into account a number of stylized facts of the African colonial period, most notably the surplus of land, the transition from subsistence production to the coexistence of food crops, export crops and resource extraction. Section IV discusses the implications of the underlying structure of gender production for women's economic empowerment and overall economic development in the post-colonial period. Section V provides the concluding remarks.

II Gendered production in SSA: Literature review and historical perspectives

Although it is relatively more difficult to trace economic research focusing on intra-household distribution of resources and gender production in pre-colonial Africa⁸—owing in a large part to the preeminence of oral traditions, absence of household surveys, and distortions of knowledge in the colonial period⁹—there is a larger body of research devoted to gender production in the colonial period [Boserup (1970), Rodney (1982), Alesina et al. (2011), Akyampong and Fofack (2012)]. The majority of these studies highlight gender segregation with respect to economic activity. In particular, they point to gender bias in the non-agricultural sector and sexual division of labor in the agricultural sector, with some types of work strongly associated with women and some with men.

Reviewing the sexual division of labor in the African colonial period, Boserup (1970) established that African women performed mostly domestic duties. Outside the household in the realm of soil cultivation, women are primarily employed as workers, helping their husband in the process of food production and conservation. As the sole owner of the family enterprise and related production factors, men enjoyed the full control of household assets and inherent production of goods as the household head.¹⁰ Thus, gender bias and sexual division of labor is largely driven by gender inequality in the distribution and ownership of assets.

However, the sexual division of labor is the part of the colonial construct that encompasses assumptions and positions of imperial powers that gained force or reality in the colonial setting through policies and institutions. A classic example is the colonial assumption that African societies were patriarchal like European societies, and that women were subordinate with no political or economic power [Saidi (2010)]. Although constructs were artificial or reifications, they gained significant force through operationalization and over time have become part of the sticky domain of gender inequality.

Inequality in the ownership of resources and sexual division of labor in the agricultural sector is widespread, irrespective of the imperial power. For instance, as part of a review of production in the central province of Cameroon—a French colony, Guyer (1978) established that husbands had the ultimate rights of disposal over the production of goods from subsistence farms, though their

⁸ This is not to say that attempts have not been made to investigate gender production and sexual division of labor in that period. Other methodological approaches have been used, most notably ethnological study of economics, social history and anthropo-geographical methods (see for instance Baumann (1928)).

⁹ See for instance, Meillassoux (1981) and Channock (1985).

¹⁰ In other words, the prominent role played by women in the subsistence agricultural production sector did not necessarily result in them enjoying the full ownership of inherent output.

contribution to food production was limited to the clearing of farms. This confinement to a single task is in contrast to women's work which was continuous and extended over the whole food production cycle. Along that cycle, farming the land, weeding and harvesting the food, was all incumbent upon women.

Hay (1976) reached the same conclusion on the theoretical division of labor in British colonies surveyed from Africa. For instance, in addition to doing most of the planting, weeding and harvesting of crops in Kenya, women in the Luo community were also responsible for housework and childcare and for storing and caring for the food supply. In contrast, Luo's men had a very specific and time-sensitive task and limited responsibility with respect to agricultural production. In addition to pastoralist activities, their contribution to food production was limited to clearing the fields and breaking the surfaces for first cultivation.¹¹

Hay's work also highlights how Luo's women adjusted to the changing economic conditions created by the advent of colonialism. In particular, they engaged in agricultural experimentation such as change in agricultural crops, and techniques of production. They adopted labor-saving and innovation techniques to reduce the time allocated to food production, a process that enabled them to reinvest the released time to other economic opportunities. This process was particularly important as women often faced competing demands on their time and had to consistently operate under time constraints.

A number of studies have established that the division of labor along gender lines in the agricultural sector was not always clear-cut, but determined by local conditions [Baumann (1928)]. Though men consistently played a role in the initial phase of agricultural production by clearing the farm, there are a number of societies where they also participated either directly or indirectly in other aspects of food production, especially with the transition from shifting cultivation (hoe culture) to plough culture. In light of this contrasting picture, Baumann (1928) took the first attempt at mapping out the contours of gender division of labor in the African hoe culture.

Figure 1 highlights two contrasting pictures of gender production: a Sudanese East African, and a West African, which later appear to expand a little to the South East. Although women's work continues to be prominent, there are geographical areas where men actively participate in the whole cycle of agricultural production, as illustrated by the vertical lines. This is particularly the case in the steppes and savannas of the Sudan and East Africa where the man shares the work of hoe culture. The husband hoes the ground, sows, weeds and harvests, alone or with women. In a few cases, for instance in the North East, men actually play a more prominent role as reflected in the thicker vertical lines. However, in the Central and West African regions, all the man does is to clear the ground, leaving all the rest of the work to the women, hence the proliferation of horizontal lines.¹²

¹¹ However, this theoretical division is also affected by socioeconomic status. While wealthy men scorned work in the fields, poor men often helped their wives with most of the agricultural tasks [Hay (1976)].

¹² At the same time, a number of authors have attributed the sexual division of labor to physical endowment. In this line, Schmidt (1923) distinguished two kinds of soil cultivation: 'forest clearing' and 'actual soil cultivation'. 'Forest clearing refers to

Still, a number of studies have focused on the extent to which the theoretical division of labor which underpinned pre-colonial Africa and produced certain equilibrium in the dynamics of gender production might have been affected by the introduction of cash crops and emergence of resource extraction during the colonial period. In this line, Mullings (1976) argues that the shift towards increased production of export crops during the colonial period destroyed the pre-existing reciprocal division of labor. While women continued to play a critical role in the field of subsistence agriculture, men abruptly reduced their initially limited contribution to the production of food crops to discretely and inelastically allocate their time to the production of cash crops and natural resource extraction as labor workers.¹³

Figure 1: Gender Division of Labor in the Hoe Culture in Africa

Source: Baumann (1928).

This transformation in the colonial period affected time allocation and time used for both men and women. The largest workload fell hardest on women who had to work even longer hours. As men gradually withdrew from food crop production to cash crops and natural resource extraction for

the typical form of cultivation in the tropical forest regions, in which the hardest work of clearing is done by men, and the easier work of setting and sowing, and also harvesting is done by women.

¹³ Along the same line, Henn (1984) argues that the introduction of cash crops transformed African households from self-sufficient production and consumption units into peasant farming producing crops for exports. Key cash crops include cotton, coffee, cocoa, tobacco and tea.

exports, women had to assume the full control of the food production cycle, from clearing farm lands and farming it to harvesting food, while at the same time being fully responsible for housework, childcare, and food supply. For instance, according to Henn (1978) women had to work 70 hours a week in Cameroon, compared to an average of 55 hours a week for men.

Empirical evidence suggests that the gender gap in the number of daily working hours remains significant in Sub-Saharan Africa. Despite the generally declining trend and reduction in the length of work in the post-colonial period, women continue to have a much longer working day in Africa. In 2007, a World Bank study noted that on average African women worked 13 hours a day in household and outside labor, while men's daily average number of hours devoted to work oscillated around 8 hours.

In addition to managing the whole food production chain, women also contributed to the growth and expansion of the cash crop industry, indirectly through their support to male workers confronted with forced labor and low wages [Guyer (1978)]. Low wages received by male workers in the cash economy had to be supplemented with food and other goods produced by women—an informal coping mechanism which may be viewed as the unpaid labor of rural women subsidizing the structurally low colonial wage (often referred to as the starvation wage). According to Henn (1984), the colonial extraction of economic surpluses from the African population through higher taxes, forced production of cash crops, resource extraction, food levied, removal of men to work on colonial enterprises were some of the main reasons behind the higher work load faced by African workers, especially women.

In addition to gender bias in the non-agricultural sector and sexual division of labor in the agricultural sector, the asymmetric nature of the relationship between men and women in the colonial period is also fuelled by inequality in access to opportunities, especially in the distribution and ownership of assets. In this line, it has been argued that women cultivate food crops by traditional methods, while men use modern scientific methods [Boserup (1970)]. At the same time, women had smaller farms, less fertile lands and limited opportunities for occupational mobility and wage employment. This point is further developed by Guyer (1984) who draws on several case studies to show that women's access to resources was inferior to men's.¹⁴

However, gender inequality and gender division of labor illustrated most notably by the preeminence of men in the cash crops and export sector is not due to any innate and intrinsic difference in men and women's ability to perform one set of tasks or the other. Different efficiencies are associated with their efforts because the tasks are gender-typed. Highlighting this point, Henn (1984) argues that African's women farming and craft activities prove that they were always physically and

¹⁴ The case studies cover west, central and southern Africa regions and focuses on the peripheral economy (the Senufo of the northern Ivory Coast), an old cash-crop economy (the Ewe of southern Ghana), labor reserve economies (Botswana and the Transkei) and female plantation worker in Cameroon.

intellectually capable of economic independence. However, these capabilities were repressed by traditional norms and colonial practices of land and crop control.¹⁵

Historical reviews and analysis have attributed the culture of entrenched gender inequality to two major repressing factors: production of export crops and the development of wage labor under gender occupational segregation [Henn (1984)].¹⁶ Other constraining factors include the emphasis on domesticity of African women by the western education system [Gaidzanwa (2003), Akyeampong and Fofack (2012)]. This form of education divorced women from many political, public and economic activities. In the process, women who became dependent on men lost their political and economic powers. According to Gaidzanwa, the confinement of women within the newly constructed private domestic domain and men in the public domain was an important aspect of Christian evangelism.¹⁷

However, the historical division of labor which underpinned the process of gendered production in the colonial period is increasingly viewed as costly for growth and economic development—both at the empirical and theoretical level [Lagerlof (2003), World Bank (2011)]. Overwhelmingly, research and studies undertaken in the post-colonial period in recent years have highlighted the benefits of gender equality for economic growth, most notably through productivity enhancement, allocative efficiency channels and intergenerational health externalities [Klasen (2002), Balamoune-Lutz and McGillivray (2009), Agenor et al. (2010)].

III A model of gendered production in colonial Africa

The colonial economy is populated by a few representative firms and a continuum of households uniformly distributed over the unit interval. The representative firms are owned either by resident colons or chartered companies headquartered in Europe. Land surplus is another characteristic feature of the African colonial economic setting. In addition, output is dominated by primary agricultural commodities (coffee, cotton and cocoa, for instance) and resource extraction in the mining sector. Economic development in the colonies is, in effect, largely dominated by these two sectors, with trading facilities, administrative institutions and the scant infrastructure essentially serving as conduit to resource extraction and export to meet the growing demands for primary commodities and natural resources in support of industrial output expansion in Europe [Rodney (1982), Sachs et al. (2004)].

¹⁵ Traditional norms comprise of a set of unwritten rules and beliefs which influence and shape expectations and behaviors of economic agents (both male and female) in a given country or community. In practice, these rules and beliefs tend to confine women's responsibility in society and define attributes of '*accepted*' behaviors.

¹⁶ This point is further supported by Boserup (1970) who argues that the division of labor became even more obvious with the introduction and expansion of cash crops during the colonial period. While subsistence crops continue to be produced by women, men were employed as workers in colonial plantations producing export crops.

¹⁷ See Comaroff and Comaroff (1992) for the impact of western missionary on women in colonial Central Africa; Labode (1993) in colonial South Africa.

Furthermore each colonial economy is engaged in the production of a continuum of nontradable goods, provided they do not compete with manufactured goods produced in the imperial power. In other words, trade is dictated by the development imperatives of the colonial power. Hence, trade routes are exclusively set up along a vertical axis—(north-south and south-north). This configuration reflects the fact that each colony can only trade with its imperial power. Neither is trade between colonies along any horizontal axis (south-south) allowed, nor is trade between the colony and any other European country besides the imperial power on the vertical axis [Fetter (1979), Akyeampong and Fofack (2012)].¹⁸

This specification is consistent with Africa’s trading patterns in the colonial and post-colonial period. Africa continues to trail other regions of the world, both developed and developing countries in the distribution of intra-regional trade. While intra-regional exports among European and Asian countries stand at more than 70% and 50% of total exports, respectively, Africa intra-regional exports are abysmally low, less than 10% [IMF (2012)]. Furthermore Africa intra-regional exports have remained low over most of the post-independence era, with averages consistently below 10% of total exports, in contrast to other regions of the world which recorded a significant increase over time, especially during the globalization era.

At less than 10%, the Sub-Saharan African share of intra-regional trade is significantly below what the gravity model of trade would predict. This fact is documented by several studies [Limao and Venables (2001), Sachs et al. (2004), Collier and Venables (2010)]. The majority of these studies have attributed the Sub-Saharan Africa’s deviation from the gravity models of trade to the design of infrastructure during the colonial period. In this line, Sachs et al. (2004) maintain that “not only does Sub-Saharan Africa have extremely low per capita densities of rail and road transport, but indeed existing transport systems were largely designed under colonial rule to transport natural resources from the interior to the nearest port.”

Analytically, this characterization of the colonial economy may also be viewed as utterly consistent with the standard Ricardian two countries framework. In effect, in addition to the restriction of trade to two countries along the vertical axis, two other features of the Ricardian framework, which are relevant to the African colonial economic setting stand out: goods are produced from labor, using constant returns to scale production functions; comparative advantage arises from differences across goods and countries in the technology for producing goods from that labor. In other words, international variation in labor productivity is exogenously given by technological differences across countries.

Besides the technological gap, the African colonial setting is also dominated by the surplus of land. Although initial attempts to model production in the colonies have emphasized the surplus of labor (with Lewis-type model assuming an infinitely elastic labor supply at the constant real wage), the surplus of land, which has been the rule rather than exception in pre-colonial and colonial Africa,

¹⁸ Imperial powers also enjoyed the monopoly of trade in the region in the post-colonial period, which partly explains the relatively low cross-border trade and deviation from gravity models of trade in the region over the last few decades [Sachs et al. (2004)].

has continued to characterize the majority of countries in the post-colonial era, though high fertility rate and increased life expectancy have also raised labor supply as reflected in the structurally high unemployment rates in recent years.¹⁹ In this regard, the extension of the standard Ricardian framework to a continuum of goods with two countries and two factors (land and labor) is even more suitable.

Against this backdrop, the framework adopted in this paper builds on Dornbusch et al.'s (1977) extension of the standard Ricardian model to a continuum of goods with two countries. However, ours emphasizes gendered job segregation and segmentation of production under complete specialization. In particular, households in the colony are endowed with two types of labor L_f, L_m , representing female (wife) and male (husband) labor, respectively.²⁰ While the employment status of eligible male household members is subject to idiosyncratic changes, oscillating between “employed” and “unemployed”, women (L_f) are always employed. The demand for labor is highly sensitive to seasonal variations in agricultural production, and elasticity of supply with respect to demand of labor in the tradable sector is high.

Women's output in the household sector is a composite commodity that includes growing and preparing food for their families, raising children and running the household. In practice, women discretely allocate their time to child rearing ($\varepsilon_t^{f,R}$), household production ($\varepsilon_t^{f,p}$) in the form of subsistence agriculture, and daily production of final consumption goods ($\varepsilon_t^{f,c}$). The latter includes the time allocated to the collection of firewood, the time spent fetching water and actual time devoted to cooking food for household daily consumption. The time constraint that women face is:

$$\varepsilon_t^f = \varepsilon_t^{f,c} + \varepsilon_t^{f,R} + \varepsilon_t^{f,p} = 1. \quad ^{21}$$

In contrast, men are essentially employed in the tradable segment of the economy—production of primary agricultural commodities and extractive industries. Output from the tradable sector is fully controlled either by resident colons or chartered companies.²² Unlike women, men invariably allocate their time to market work ($\varepsilon_t^{m,w}$) and leisure (l_t^m). In a labor market that is highly segmented along gender lines and where production is influenced by both gender and colonial constructs, the time constraint that men faces is provided by: $\varepsilon_t^m = \varepsilon_t^{m,w} + l_t^m \leq 1$, where l_t^m is

¹⁹ The abundance of land has continued to be the hallmark of the continent, even in post-colonial times, as illustrated most recently by the rush to land grab.

²⁰ Child labor could have been factored into the model since children may actively participate in household production. However, including children will not change the overall structure of the model from the gender and growth analysis standpoint, especially if one assumes equal probability of giving birth to boys and girls.

²¹ A number of models have included leisure in the constraint facing women in their daily production (see Darity (1995) for example). However, the ‘double day’ time constraint often referred to holds under the proposed framework. Women's occupational constraint is such that they always work more than what is required and have no time for leisure.

²² In the African context, chartered companies were specifically formed for the purpose of resource extraction. The main feature of these companies is their involvement in the mining sector. These companies flourished when resource extraction is achieved under no restriction—hence there was little incentive for these companies to invest in human capital and little attempts to develop domestic governance structures. Infrastructure was only supporting mining and related activities [Rodney (1982), Sachs et al. (2004)].

the time allocated to leisure by men. The restriction to $\varepsilon_t^m \leq 1$ under this specification implies that $(\varepsilon_t^m < \varepsilon_t^f), \forall t$ (men do not take part in home production).

This restriction also leaves time for men to engage in leisure, which may not necessarily be utility-enhancing and augmenting for the household as a whole. However, the decision to allocate the extra time either to productive activities or leisure is equally affected by a number of considerations, including intra-household bargaining power, and the business cycle. The latter is determined by seasonal variations in the patterns of primary commodity production, level of global demand for primary commodities and natural resources. Under the highly segmented labor and product markets that is characteristics of the African colonial economic setting, home consumption of non-tradable goods (j) in household (i) is produced with labor (L_f^i) and land ($Z^i(M)$), according to standard constant returns to scale production functions:

$$Y_{i,j}^N(\bullet) = f(L_f^{i,j}, Z^{i,j}(M)) \quad Y_{i,j}^N > 0 \text{ and } j \leq k \quad (1)$$

The variable $Z^{i,j}(M)$ is the marginal land used by households (i) to produce the nontradable goods j , where $(0 < j < k, \text{ with } k < \aleph)$ represents the expanding set of non-tradable goods (with $\aleph$ being the upper bound). Likewise, $L_f^{i,j}$ is household (i) female labor used to produce the nontradable good j , and $f(\cdot)$ is a concave production function. Recall that in the African colonial setting women are exclusively employed in home production and the native population does not have access to the more productive intra-marginal lands.²³ Moreover, in the absence of technology, productivity is mainly driven by physical labor in the non-tradable sector. This allocation of surplus of land on the basis of land quality is consistent with Ricardo's theory of differential rent, although at variant with the standard model which assumes homogeneous land.

Under the gendered job segregation framework, women are exclusively engaged in subsistence agriculture and home production. Tradable goods (T), whether primary agricultural commodities grown on the more fertile intra-marginal lands or natural resources (predominantly mining in the colonial period, and a combination of mining and oil and gas extraction in the post-colonial period in recent years) from extractive industries are produced according to the constant returns to scale production function:

$$Y_{i,j}^T(\bullet) = f(L_f^{i,j}, Z^{i,j}(IM)) \quad Y_{i,j}^T > 0 \text{ and } J > k \quad (2)$$

The subscript j is defined such that $(k + 1 < j < k + n, \text{ with } n < \aleph)$ and represents the set of tradable goods (expanding over time) produced in a given colony. The upper bound $\aleph$ depends on the wealth (natural resources) available in that colony. The number k may also be viewed as the cut-off point (dividing-line) between tradable and nontradable goods in the continuum space of

²³ Wherever white settlement took place in large scale extending beyond urban areas, the indigenous population was driven off the high-yielding and fertile land to the benefits of European colons. The long-term effects of such colonial policies are still visible nowadays in several countries across Africa, including Kenya, South Africa and Zimbabwe.

aggregate output. Again, the production of tradable good $Y_{i,j}^T$ is entirely controlled either by resident colons or chartered companies, which have the full ownership of the more productive intra-marginal land $Z^{i,j}(IM)$. Aggregate output in the colony in any given year ($Y^C(\cdot)$) is the sum of total tradable and nontradable production:

$$Y^C(\cdot) = \sum_{i,j} f(L_f^{i,j}, Z^{i,j}(M)) + \sum_{i,j} f(L_m^{i,j}, Z^{i,j}(IM)) \quad (3)$$

The productivity gap and difference in the type of crops grown on marginal land Y^N and intra-marginal lands Y^T implies that men and women do not have access to the same technology and operate on different production possibility frontiers. Resident colons and chartered companies have access to global technology. At the same time, the differences in technological endowment between colonies and imperial powers are even starker. The latter basically draws on its superior technology to enjoy monopolistic advantages (two countries trade model) and higher marginal product of labor and capital in manufacturing production, which account for the lion's share of exports to colonies.²⁴

In addition to the confinement to marginal lands and segmentation of product markets, both of which have significant implications for welfare and gender inequality, the effects of colonial policies also operate through the tradable sector. Unlike subsistence agricultural production that is mainly destined to home consumption, the tradable sector is highly monetized and enjoys higher rates of growth and productivity in part due to higher capital-output ratio and preeminence of skilled labor. Let A and M be two trading economies linked by colonial arrangements such that A is an African colony and M is the imperial power (M also stands for Motherland).

Each country enjoys a comparative advantage over a disjoint product space under the colonial arrangement. Adverse patterns of trade under that colonial arrangement grant exclusive concessions to the colonial power on the production of high valued-added goods, and in the process confines colonies to a dependency status. These patterns of trade have continued into the post-colonial era and have been exacerbated by gaps in skills and technological infrastructure. Reflecting these patterns of specialization, country M exports are dominated by manufactured goods and Country A's exports are dominated by primary commodities and natural resources.

If we index these goods by the continuous variable (j) on the unit interval $[0, 1]$, define the function specifying factor input for the colonial economy A as $a^A(j)$, representing the amount of labor and intra-marginal land required to produce one unit of tradable good j , in a country A, and $a^M(j)$, representing the amount of labor and technology required to produce one unit of good j in country M, then we have the following ratio:

$$A(j) = \frac{a^A(j)}{a^M(j)}, \quad \text{with } a^A(j) > 0 \text{ and } a^M(j) > 0 \quad (4)$$

²⁴ However, with the rise of Asia the absolute comparative advantage enjoyed by European nations during pre-colonial and colonial times, as a result of their technological edge, has decreased significantly over the last few decades, resulting in income convergence between the traditional industrialized nations and emerging market economies [Fofack (2009)].

Note that the comparative advantage of country A over its product space implies that:

$$a^A(j) \leq a^M(j) \quad \forall j \leq k,$$

$$a^A(j) > a^M(j) \quad \forall j > k.$$

In other words, the factor input required to produce a given unit of tradable good j would be inferior to the level required to produce that same good in the imperial power.²⁵ The restriction to $j > k$ reflects the fact that the two economies operate under complete specialization. Equation (4) provides the chain of relative input requirements used to establish country's comparative advantage. Letting $w = w^A/w^M$ (where $w^A(j)$ and $w^M(j)$ are relative wages associated with the production of any good j in country A and M, respectively) will lead to country A producing and exporting all goods with $A(j) > W(j)$ and importing goods with $A(j) < W(j)$ (see Figure 2). Dotted lines in figure 2 reflect complete specialization over the combined product space.

Figure 2: Static trade equilibrium under complete specialization

To determine the equilibrium value of w one needs assumptions about demand, $M(j; L^M/L^A)$. The variables L^A and L^M are supply of labor in country A and M, respectively. In the colonial setting, $L^A = L_m$ (women are not engaged in the tradable sector). Assuming that preferences are identical and Cobb-Douglas, this curve measures the relative wage at which country A exports equal its

²⁵ In addition to fixed investments, land is also an important part of capital, especially in the area of subsistence agriculture and food production.

imports.²⁶ In practice, this market clearing mechanism depends on $\theta(j)$, the fraction of income spent on goods produced by country $\mathcal{A}$, which in turn rises with country $\mathcal{A}$'s output.

In other words, income in the tradable sector will rise with the level of production and aggregate demand. It also depends positively on the relative size of country $\mathcal{M}$. For any division of goods between the two countries, the larger the size of $\mathcal{M}$, the higher must be the relative wage in $\mathcal{A}$ to keep the expenditure ratio constant. Hence, as aggregate output and demand in the imperial power expands, the growth dividends largely accrue to the tradable sector. Although consistent with the exporter wage premium hypothesis (see Bernard and Jensen (1999)), this process may increase gender disparity and income inequality between men and women as a result of gender bias in the tradable sector.

At the same time, the comparative advantage and delineation of the product space under the colonial economic setting is not simply dictated by wage structure, price advantage and differences in productivity across sectors, it also depends on natural resources and technological endowment. And when all the parameters driving output growth are taken into account, a comparison across sectors suggests that productivity growth is likely to be much higher in the tradable sector. Home-produced non-tradable and imported goods financed by wage income received by male household members (husbands) working in the tradable production sector make up the household basket of aggregate consumption goods. If the vector $\mathbf{C}^i$ denotes the consumption level of indigenous households in the colony (i), then aggregate consumption within the household is given by:

$$\begin{aligned}\mathbf{C} &= (\rho \mathbf{C}_f^N + \bar{\rho} \mathbf{C}_m^N) + (\rho \mathbf{C}_f^I + \bar{\rho} \mathbf{C}_m^I) \\ &= \rho(\mathbf{C}_f^N + \mathbf{C}_f^I) + \bar{\rho}(\mathbf{C}_m^N + \mathbf{C}_m^I)\end{aligned}$$

The terms $\mathbf{C}_f^N$ and $\mathbf{C}_f^I$ are consumption of nontradable and tradable (imported) goods of female household members, and $\mathbf{C}_m^N$ and $\mathbf{C}_m^I$ are the same consumption by male household members, and ρ (with $\rho < 1$ and $(\bar{\rho} = (1 - \rho))$) is the bargaining power. The bargaining power determines the extent to which wage income from tradable production, which is partly used to finance the acquisition of imported goods, equally benefits husband and wife in any given household. Even assuming that income is pooled at the level of household unit, men are likely to enjoy relatively higher consumption if $(\rho < 0.5)$. Furthermore, assuming that access to public goods, including the scant public infrastructure and education institutions cannot be discriminated on the basis of gender, the utility of household members h , with $h \in \{f, m\}$ is given by:

$$U_h = U(\mathbf{C}_f, \mathbf{C}_m, L_f, L_m, l_t^m, \rho) \quad (6)$$

Household utility therefore depends on male and female labor force participation, and consumption level of tradable and nontradable goods, given the relative bargaining power of women and time

²⁶ This equilibrium relationship in the external sector simply requires that the ratio of expenditures on the two sets of goods equal the ratio of incomes of those who produce them.

allocated to leisure by men. Income accruing to the household from tradable production depends on the trade-off operated by men in the allocation of their time between market work and leisure. In practice, the distribution of utility across household members will tend to equalize when women have strong bargaining power or when opportunities for employment in the tradable sector are unlimited and the colonial policy of forced labor is fully implemented, hence constraining the leisure time for men.²⁷

The market of tradable goods is perfectly competitive so that any goods (j) is priced at costs in a country that produces it ($P_j^c = w^c(j) a^c(j)$) where $c \in \{A, M\}$ and $w^c(j)$ and $a^c(j)$ are the competitive wage in country c and the amount of labor needed to produce a good j in that country. Assuming that $\mathbf{P}$ is the price vector, then the budget constraint facing households is provided by:

$$\mathbf{P}\mathbf{C} \leq \mathbf{P}\mathbf{Y} \quad (7)$$

A Pareto-efficient allocation of resources within the household solves:

$$\max_{c_h, L_h, \rho, L_m, \varepsilon_t^h} [U_f(\cdot) + \lambda U_m(\cdot)] \quad (8)$$

For some $\lambda > 0$ and where $h \in \{f, m\}$. The household utility is such that $U'_h(\bullet) > 0$ and $U''_h(\bullet) \leq 0$. If $\sum_i L_f^i$ and $\sum_i L_m^i$ are the aggregate quantity of female and male labor input into the production process, then equation (8) implies that the allocation of labor across the product space solves:

$$\max_{L_f^i, L_m^i} [\sum_{i,j} f(L_f^{i,j}, Z^{i,j}(M)) + \sum_{i,j} f(L_m^{i,j}, Z^{i,j}(IM))] \quad (9)$$

subject to $\sum_i L_f^i = L_f$, $\sum_i L_m^i = L_m$, and $L_f^i, L_m^i > 0$. And $\sum_i Z^i(M) = Z(M)$, $\sum_i Z^i(IM) = Z(IM)$ and $Z^i(M), Z^i(IM) > 0$.

IV Implications for gender inequality and growth

The framework drawn upon to describe the contours of gender production in colonial Africa in this paper has several implications for gender inequality and growth in the region. For instance, it can be used to assess the implications of gender inequality for the distribution of income and consumption during the colonial times. It can also be drawn upon to assess the implications of underlying colonial constructs for persistent gender inequality, growth and structural balance of payments deficits.

Primary commodity exporters which have a high concentration of exports (low economic diversification) are more exposed to adverse terms of trade shocks than the more diversified and manufacturing export nations [Prebisch (1950), Singer (1950)].

²⁷Forced labor was common in the colony, especially in the settler rule. Young (1994) provides a nice taxonomy of the different type of colonial rule in Africa. Key components of that classification includes: company rule, direct rule, indirect rule and settler rule.

In this section, we particularly focus on the potential implications of the underlying framework for persistent gender inequality, both in the colonial and post-colonial period. Possible channels, through which the proposed analytical framework may be used to enhance understanding of gender inequality dynamics include sectoral productivity gap—the driver of output gaps between men and women during colonial period. In particular, while the tradable sector had access to frontier technology, the non-tradable sector did not. Still, there are other channels, including terms of trade, gender bias in the process of accumulation, especially as a result of income differential between tradable and non-tradable sectors.

In addition to the distinction between marginal and intra-marginal lands and complete specialization, the proposed framework is also characterized by the disjoint nature of tradable and non-tradable sectors. While the non-tradable sector is largely populated by women, the tradable sector operates under the assumption of gender bias whereby women are completely excluded from the production of tradable goods—sectoral discrimination. In this section, we review the possible welfare implications of the colonial economic construction underpinned by the proposed analytical framework in the form of a series of propositions.

Proposition 1: *Under the Sub-Saharan African colonial economy of perfect segmentation of tradable and non-tradable production, the average income accruing to women and men satisfies:*

$$\bar{I}_{c,f} \leq \bar{I}_{c,m} , \text{ for any colony } c$$

Proof: Let $\bar{I}_{c,f}^N$ and $\bar{I}_{c,m}^T$ be the average income accruing to women in the non-tradable sector and to men in the tradable sector in any given colony, respectively. Furthermore, let assume that all factors of production earn their marginal product. In order to account for sectoral bias in the structure of production technology between the two sectors the proposed analytical framework emphasizes sectoral segmentation. Production in the tradable sector is driven by both physical and skilled labor. In contrast, non-tradable production is exclusively attributed to physical labor.

In addition, let $W_t^{P_N}$ be the return to a unit of physical labor at time t in the non-tradable sector, and W_t^S be the return to a unit of skilled labor in the tradable sector over the same period.

Furthermore, let assume that $W_t^{P_N} = P_N$ (where P_N is constant, reflecting the absence of technology for productivity enhancement in the non-tradable sector). Drawing on Galor and Weil (1996) formulation, the returns to a unit of skilled labor can be represented as follows:

$$w_t^S = a(1 - \alpha)S_t^{\mu-1}[\alpha K_t^\alpha + (1 - \alpha)S_t^\mu]^{\frac{1-\mu}{\mu}} \quad (10)$$

This specification is different from the one proposed by Galor and Weil. Their assumes that women and men have equal amount of brain power, but that men have the monopoly of brawns, with returns to brain increasing relative to brawns as the economy accumulates more physical capital. In contrast and reflecting the African colonial setting of occupational job segregation, skilled labor is not required in the non-tradable sector. Hence, women are only endowed with physical labor,

whereas men are endowed with both skilled and physical labor in the tradable sector, with skills increasing as a result of learning by doing.

In equation (10) the variable K_t is the capital stock, $S_t = \frac{L_t^S}{L_t^P}$ is the input of skilled labor into the production process. Skilled labor may depend on the extent of “on-the-job training”, but also on the level of education at entry in the tradable sector. Other coefficients and parameters are defined as follows: $\alpha > 0$, $\alpha \in (0,1)$, $\mu \in (-\infty, 1)$.²⁸ Furthermore, if $\bar{R}_N$ is aggregate returns from labor averaged over the non-tradable production space, then,

$$\bar{R}_N = \sum_{t=1}^{n_f} \frac{W_t^{P_N}}{n_n} = P_N \quad (11)$$

Recall that P_N is constant. On the other hand, aggregate returns from a unit of labor averaged over the tradable production space can be represented by:

$$\bar{R}_T = \sum_{t=1}^{n_m} \frac{(W_t^{P_T} + W_t^S)}{n_m} \quad (12)$$

For all practical purposes, this formulation assumes that workers in the tradable sector are endowed with both physical and skilled labor, though workers are not always equally endowed in both physical and skilled labor over the production space. A scenario whereby workers may well be exclusively endowed with physical labor at the lowest level of job entry, with skills acquisition improving over time, as a result of “on-the-job training” may well be the most prevalent path. In order to validate proposition 1, we want to establish that $\frac{\bar{R}_T}{\bar{R}_N} > 1$. In practice, the ratio of average returns from a unit of labor in the tradable over the non-tradable sector of production can be represented as follows:

$$\frac{\bar{R}_T}{\bar{R}_N} = \frac{\sum_{t=1}^{n_m} (W_t^{P_T} + W_t^S)}{\sum_{t=1}^{n_f} W_t^{P_N}} \cdot \left(\frac{n_f}{n_m} \right) \quad (13)$$

$$\frac{\bar{R}_T}{\bar{R}_N} = \frac{\sum_{t=1}^{n_m} (W_t^{P_T} + W_t^S)}{\sum_{t=1}^{n_f} W_t^{P_N}} \cdot \left(\frac{n - n_m}{n_m} \right)$$

²⁸ $\mu \in (-\infty, 0)$ implies that the elasticity of substitution between capital and skilled labor is smaller than one. However, as μ increases in absolute value, the complementarity between capital and skilled labor rises.

Equation (13) assumes that $n_f + n_m = n$, where n_f is the population of active female labor force, n_m is the population of active male labor force and n is the total population of active labor force. However, if $n_f = n_m$ then,

$$\frac{\bar{R}_T}{\bar{R}_N} = \frac{\sum_{t=1}^{n_m} (W_t^{P_T} + W_t^S)}{\sum_{t=1}^{n_m} W_t^{P_N}} \quad (14)$$

$$\frac{\bar{R}_T}{\bar{R}_N} = \frac{\sum_{t=1}^{n_m} W_t^{P_T}}{\sum_{t=1}^{n_m} W_t^{P_N}} + \frac{\sum_{t=1}^{n_m} W_t^S}{\sum_{t=1}^{n_m} W_t^{P_N}} \quad (15)$$

$\frac{\bar{R}_T}{\bar{R}_N} > 1$ because $\sum_{t=1}^{n_m} W_t^S > 0$ and $\sum_{t=1}^{n_m} W_t^{P_T} \geq \sum_{t=1}^{n_m} W_t^{P_N}$ (by extension of the wage premium hypothesis which posits that only the most productive firms become wage exporters).²⁹

In other words, the average income accruing to individual workers in the tradable sector will tend to be larger than the average income accruing to smallholder subsistence farmers operating in the non-tradable sector, irrespective of gender and female bargaining power. To the extent that the non-tradable sector is largely populated by women, the process of gender inequality whereby women receive lower returns on average than men ($\bar{I}_{c,f}^N < \bar{I}_{c,m}^T$) is largely driven by occupational job segregation or sectoral discrimination during the colonial period; hence, $(\bar{I}_{c,f}^N < \bar{I}_{c,m}^T \Rightarrow \bar{I}_{c,f} < \bar{I}_{c,m})$.

The welfare gap between tradable and non-tradable sectors is further depicted by Figure 3 below. Intuitively, proposition 1 implies that regardless of gender, imputed income from subsistence production does not depend on the productivity of labor. Since physical labor is uniformly distributed across non-tradable sector, the resulting income averaged over the support of the distribution ($\bar{I}_c^N$) is flat up to k (the cut-off point). On the other hand, average income in the tradable sector is affected by labor productivity (physical and skilled labor), and the relative increase after the cut-off point (from $\bar{I}_c^N$ to $\bar{I}_c^T$) is largely attributed to productivity enhancement owing in a large part to the contribution of skilled labor to output growth.

However, in all scenarios, the curvilinear shape of the hypothesized distribution of income over the tradable production space reflects the diminishing returns of labor productivity over time. The upward shift in average income from $(\bar{I}_c^T \rightarrow \bar{I}_c'^T)$ (dotted lines) reflects the increasingly large share of manufactured goods in global trade, a consequence of leftward shift in the cut-off point from

²⁹For more details see Bernard and Jensen (1999).

$(k \rightarrow k')$. Even in the post-colonial era where access to technology has been more diffused (contributing to upward shift in average income in the non-tradable sector, from $\bar{I}_C^N \rightarrow \bar{I}_{PC}^N$) the tradable sector continues to enjoy higher average income ($\bar{I}_{PC}^T > \bar{I}_{PC}^N$).

Figure 3: Effects of increased stock of human capital (skills and physical capital) on welfare

Proposition 2: *On average, the tradable sector of the economy, which enjoyed access to global technology during the colonial period, exhibited higher per capita output than the non-tradable sector.*

Proof: Recall that the constant returns to scale tradable and non-tradable production functions takes the following form:

$$Y^N(\bullet) = f(L_f, Z(M)) \text{ and } Y^T(\bullet) = f(L_m, Z(IM))$$

If one assumes that output in both non-tradable and tradable sectors is based on a Cobb-Douglas production function, then the initial production functions can be represented as follows:

$$Y^N(\bullet) = AZ^\alpha(M)L_f^{1-\alpha} \quad (16)$$

and

$$Y^T(\bullet) = AZ^\alpha(IM)L_m^{1-\alpha} \quad (17)$$

Where $Z(M)$ and $Z(IM)$, marginal and intra-marginal lands, are substitutes for capital in the non-tradable and tradable sectors, respectively. The variables $L_p = L_f$ and $L_m = L_{(p,s)}$ are labor endowment in the non-tradable and tradable sectors, respectively. The subscript p and s represents physical and skilled labor, and $(1 - \alpha)$ is the output elasticity of labor, α is the output elasticity of capital proxied by lands (marginal and intra-marginal). $A(A > 0)$ is technological change.

Furthermore, technological change is assumed exogenous, and the amount of labor and capital has no impact on technological change. In fact, technology is fully imported to enhance productivity and output growth in the tradable sector. At the same time, in a colonial setting where perfect competition did not exist, labor did not earn its marginal product, but its marginal revenue product. Hence multiplying (16) and (17) by the price of output P_{YN} and P_{YT} yields:

$$Y^T(\bullet) = P_{YT}AZ^\alpha(IM)L_m^{1-\alpha} \quad (18)$$

$$Y^N(\bullet) = P_{YN}Z^\alpha(M)L_f^{1-\alpha} \quad (19)$$

Note that smallholder farmers engaged in subsistence agricultural production do not benefit from advances in technology at the global level (hence $A=1$). Under the above specification, tradable and non-tradable output $Y^T(\bullet)$ and $Y^N(\bullet)$ are measured in current dollars, representing the nominal output in each country. We want to establish that $Y^T(\bullet) > Y^N(\bullet)$:

$$\frac{Y^T(\bullet)}{Y^N(\bullet)} > 1 \Rightarrow \frac{P_{YT}AZ^\alpha(IM)L_m^{1-\alpha}}{P_{YN}Z^\alpha(M)L_f^{1-\alpha}} > 1 \quad (20)$$

Intuitively, $(Y^T(\bullet) > Y^N(\bullet))$ by Balassa-Samuelson (BS) hypothesis, which conjectures that productivity increases in the tradable sector tend to be higher than those in the non-tradable sectors $\left(\frac{\partial Y^T(\bullet)}{\partial Z(IM)} > \frac{\partial Y^N(\bullet)}{\partial Z(M)} \text{ and } \frac{\partial Y^T(\bullet)}{\partial L_m} > \frac{\partial Y^N(\bullet)}{\partial L_f}\right)$. In the colonial setting, the BS hypothesis may be further supported by the higher fertility and productivity of intra-marginal lands over marginal lands. Furthermore, $A > 0$ and $P_{YT} \geq P_{YN}$ because the supply elasticity of tradable goods is infinite, unlike the supply elasticity of non-tradable goods that is constant. In the extreme case of an endowment economy, the supply elasticity of non-tradable goods is actually equal to zero.

Moreover, the non-tradable sector of the economy may also suffer from inefficiencies associated with the absence of transnational transport infrastructure for an effective mobility of goods and labor. These adverse effects of infrastructure deficits have persisted into the post-colonial period and are undermining economic growth and intra-regional trade. According to Collier and Venables (2010), the interior-to-coast transport infrastructure established by the colonial administration

continues to have negative welfare effects on local and regional industries that compete with imports from overseas countries.

Proposition 3: *Countries that have production processes governed by a colonial model of natural resource extraction and primary agricultural commodities are more likely to face structural current account deficits than more diversified economies.*

The proof draws on standard national income identity as follows:

$$Y_t = (C_t^d + I_t^d + G_t^d) + CA_t \quad (21)$$

According to this standard formulation, total output at any time t is the sum of total consumption expenditure, total investment expenditures, total government expenditure, and the current account, where $CA_t = EX_t - IM_t$. In current account terms, identity (21) can be represented as:

$$CA_t = Y_t - (C_t^d + I_t^d + G_t^d) \quad (22)$$

We are assessing the effects of the colonial production structure dominated by exports of primary agricultural commodities and natural resources on the country current account, which over time, is affected by the volatility of commodity prices. Hence identity (22) can be expanded to take the following representation:

$$\begin{aligned} CA_{t0} &= Y_{t0} - (C_{t0}^d + I_{t0}^d + G_{t0}^d) \\ CA_{t1} &= Y_{t1} - (C_{t1}^d + I_{t1}^d + G_{t1}^d) \\ CA_{t2} &= Y_{t2} - (C_{t2}^d + I_{t2}^d + G_{t2}^d) \\ &\dots \quad \dots \quad \dots \\ CA_{tn} &= Y_{tn} - (C_{tn}^d + I_{tn}^d + G_{tn}^d) \end{aligned}$$

We would like to establish that $\lim_{t \rightarrow \infty} \sum_{t=t0}^{tn} CA_{tn} \rightarrow -\infty$. For any given country, $\exists t \in (1, \infty)$ such that $CA_t < 0 \Rightarrow IM_t > EX_t$. In practice, such a scenario is highly likely and reflects the current account deficit. The deficit may be the result of terms of trade deterioration, volatility of commodity prices, but also changing patterns of global trade increasingly dominated by manufactured goods. According to available estimates, manufactured goods accounted for more than 80% of total exports in 2010, up more than 60 percentage points from the 1970s [UNCTAD (2012)].³⁰ These patterns of global trade may actually exacerbate the risk of current account deficits for primary commodity export countries.

³⁰ Export diversification and rising share of manufacturing in aggregate output and exports have been the main drivers of sustained economic growth rates and reserve accumulation achieved by East Asian emerging market economies. According to available estimates, manufactured goods accounted for over 80 percent of East Asian emerging markets' total exports in the years preceding the global downturn [UNCTAD (2012)].

Although a number of countries in the region have benefited from an oil boom following exponential growth in global demands and prices in recent years, they remain vulnerable to the volatility of commodity prices. Furthermore, in the long run, the risk of current account deterioration is not excluded because population pressure is likely to result in rising demands for and domestic consumption of imported manufactured goods, even if one makes abstraction of risks of terms of trade deterioration.

Suppose $IM_t = \theta_t \overline{MG}_t + (1 - \theta_t)MG_t$. Where θ_t ($0 < \theta_t < 1$) $\forall t$, and $\lim_{t \rightarrow \infty} \theta_t \rightarrow 0$ (asymptotically and reflecting the rising share of manufactured goods in global trade over time). Imports of any given colony is a composite share of primary products, for which colonies do not have comparative advantage and manufactured goods, with the share of manufactured goods in total imports increasing over time. The variable MG_t stands for manufactured goods imported at time t and $\overline{MG}_t$ represents other goods (non-manufactured goods) imported over the same period. Furthermore, let assume that $EX_t = \phi_t IM_t$, with $\phi_t \in (0, q)$ where ($q > 1$) and ($q < \infty$) (q is a fixed natural integer), then the current account identity can be rewritten as follows:

$$\begin{aligned}
CA_t &= EX_t - IM_t \\
&= \phi_t IM_t - \theta_t \overline{MG}_t - (1 - \theta_t)MG_t \\
&= \phi_t \theta_t \overline{MG}_t + \phi_t (1 - \theta_t)MG_t - [\theta_t \overline{MG}_t + (1 - \theta_t)MG_t] \\
&= \phi_t \theta_t \overline{MG}_t + \phi_t (1 - \theta_t)MG_t - \theta_t \overline{MG}_t - (1 - \theta_t)MG_t \\
&= \theta_t \overline{MG}_t (\phi_t - 1) + (1 - \theta_t)MG_t (\phi_t - 1) \\
&= (\phi_t - 1) [\underbrace{\theta_t \overline{MG}_t + (1 - \theta_t)MG_t}_{+}]
\end{aligned}$$

$(\theta_t \overline{MG}_t + (1 - \theta_t)MG_t) > 0$, hence $CA_t < 0$ if $\phi_t < 1$. Let $\lim_{t \rightarrow \infty} \sum_{t=1}^{\infty} (\phi_t - 1) [\theta_t \overline{MG}_t + (1 - \theta_t)MG_t]$ be the cumulative sum of current account of a given colony over time. Assuming that the production structure in the colony is unchanged (that country aggregate output continues to be largely dominated by raw materials and primary agricultural commodities), then $\lim_{t \rightarrow \infty} p(\phi_t < 1) \rightarrow$

1. This outcome is likely, as $t \rightarrow \infty$, $\theta_t \rightarrow 0$ (over time, manufactured goods account for an increasingly larger share of global trade). This outcome could be due to a combination of several other factors, including terms of trade deterioration consistent with the Prebisch-Singer hypothesis, and higher rate of imports of manufactured goods as a result of changing pattern of global trade and boom in population growth in the former colonies.

$$\lim_{t \rightarrow \infty} p(\phi_t < 1) \rightarrow 1 \Rightarrow \lim_{t \rightarrow \infty} \sum_{t=1}^{\infty} (\phi_t - 1) [\theta_t \overline{MG}_t + (1 - \theta_t) MG_t] \rightarrow -\infty.$$

Over time, these patterns of global trade may actually exacerbate the risks of structural current account deficit for natural resource and primary commodity export countries. Even hypothetically assuming favorable terms of trade whereby price and global demands are not subject to adverse shocks the growing demand of manufactured goods fueled by rapid population growth can lead to structural trade deficits. Under such a scenario, a small natural resource-dependent economy can move from a trade surplus to a deficit. In the case of countries exporting non-renewable natural resources, such as fossil fuels, the long-term risks are even more significant. Historically, countries have mitigated these risks and enhanced their integration into the global economy by adopting policies that promote economic and export diversification.

Figure 4 illustrates the dynamics of welfare and potential implications for structural current account balance under complete specialization whereby the monopoly of producing high value-added goods in the Motherland has reduced African colonies to a dependency status. The reduction of country A's exports is reflected in the leftward shift in the cut-off point from k to k' . However the leftward shift also results in a concurrent reduction of welfare, with the average expected wage declining from $\bar{w}$ to $\bar{w}'$.

Figure 4: Dynamic equilibrium under complete specialization

At the same time, the patterns of growth dominated by primary commodities may inhibit growth prospects in the post-colonial period. For example a number of studies find that the ratio of manufactured exports to GDP has a positive effect on growth, whereas primary commodity exports to GDP do not [Levin and Raut (1997), Sachs and Warner (1997)]. This contrasting outcome might be explained by the fact that imports of manufactured goods for final consumption has very limited spillover effects on the productivity and output growth.

The policy implications derived from the proposed analytical framework rest on the hypothesis of resilient colonial constructs and persistent effect of colonial institutions on growth and economic development in the Sub-Saharan Africa region long after the end of the colonial regime. The persistence of institutions has long been established and the thesis that institutions persist for a long time goes back to at least Wittfogel (1957). More recently, authors such as Young (1994), Engerman and Sokoloff (1997), La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) have argued in favor of the persistence of colonial institutions in the post-colonial period, with Engerman, Mariscal and Sokoloff (1998) providing further empirical evidence supporting this view.

However, one question remains: why have the residual effects of colonial institutions been much stronger in the continent of Africa where development outcomes, especially in resource-rich countries, have been worse than averages, even by developing country standards? Empirical research on the colonial origins of comparative development contrasting development outcomes in countries on the basis of settlement policy and typology of colonial institutions provides an element of response to this question. In particular, in a seminal paper on the topic, Acemoglu, Johnson and Robinson (2001) established a chain of causality linking settler mortality rates, institutions and economic performance.

More specifically, these authors empirically establish that “settler mortality rates were a major determinant of settlements; that settlements were a major determinant of early institutions; that there is a strong correlation between early institutions and institutions today; and finally that current institutions have first-order effect on current performance.” Drawing on this causal chain triggered by health and epidemiological conditions in the colony, they establish that settler patterns explain over 50 percent of the variation in early institutions in effect in developing countries. In other words, mortality rates faced by potential settlers affected settlement behavior, which in turn determined the type of institutions that the colonialists brought to the country and ultimately economic and development outcomes.

As a corollary, colonial territories where settler mortality rates were high and dissuaded incoming Europeans against settling, received the worse type of institutions—extractive institutions. In contrast, colonies with favorable epidemiological conditions and low mortality rates received better institutions that established the right infrastructure for endogenous growth. Using settler mortality rates as an instrumental variable, these authors largely attribute the poor performance achieved by Sub-Saharan African countries to the resilience and proliferation of extractive institutions inherited from the colonial era in the region. In effect, except in a few cases such as Mauritius and South Africa, where Europeans settled in large numbers, the institutions inherited from the colonial

administration were primarily extractive in the overwhelming majority of African countries and have persisted to this day.³¹

V Conclusion

In addition to shedding some light on African economic history, a research area that has not received enough attention in the economic discipline over the last few decades, this paper adapts the standard Ricardian framework to the analysis of gender production in the African colonial economic setting of occupational job segregation in the agricultural sector and gender bias in the non-agricultural sector. The fundamental feature of the model is the expansion of the set of goods to account for infinite production possibilities over the tradable and non-tradable production space, and to capture the changing composition of tradable and non-tradable production in aggregate output over time.

Drawing on the proposed analytical framework, the paper shows that gender inequality in colonial Africa is largely due to occupational job segregation—a consequence of mutually reinforcing colonial constructs and social norms. In effect, under the colonial development model of segmentation of production and complete specialization the emergence of gender inequality where men enjoy higher average income is hardly surprising. Production in the colonies is dictated by the confines of colonial constructs: the tradable sector, which is part of the global economy and draws on frontier technology for productivity growth, is largely populated by men, whereas the non-tradable sector that is disconnected from the world economy has women as the predominant labor force.

In addition to intensifying gender inequality, the colonial economy also has significant implications for aggregate output and balance of payments in the post-colonial period. In particular, it is shown that countries whose exports are dominated by natural resources and primary agricultural commodities are more likely to face recurrent current account deficits than the more diversified nations. Under the new globalization framework where global trade has been increasingly dominated by manufactured goods, the adverse patterns of specialization, whereby high value-added activities are exclusively produced in the motherland, exacerbated the dependency of countries in the region to their former colonial power in the decades following independences and more recently on emerging market economies.

The rise of Asian emerging market economies over the last few decades has prompted a new cycle of commodity price boom sustained by impressive acceleration in global demand for natural resources. While this new cycle has increased the fiscal space and improved the external position of

³¹ The French settled in relatively large number in Mauritius in the 18th century. The first French Governor of the island was an engineer specialized in the design and construction of fortified buildings. Under his leadership, the colonial administration quickly established Port Louis as a naval base and shipbuilding center, promoted a development policy anchored around the family life by encouraging many French and Europeans to migrate to Mauritius through a set of incentives, including free access to land and slave labor from neighboring countries.

several resource-rich countries, it has not really changed the globalization landscape insofar as the region is concerned: most countries remain highly exposed to the volatility of commodity prices and adverse terms of trade shocks, the contribution of the region to global trade remains abysmally low, and informal sector employment has emerged as a temporary alternative to the shortage of jobs in the formal sector. With Africa's working age population projected to grow by more than 13 million every year in the coming decades,³² the extension of the colonial development model, where countries in the region are connected to the global economy as primary commodity exporters, will only exacerbate downside risks, such as current account deficits and poverty.³³

The recurrence of these risks is consistent with the "Prebisch-Singer" hypothesis. Recurrent current account deficits reflect the secular decline in the terms of trade of primary commodities vis-à-vis manufactured goods. This risk has probably been exacerbated by rapid population growth in the region in recent years, and is likely to increase even more in the coming decades, especially with the African population projected to double by 2050.³⁴ In the medium and long-term, successfully integrating African countries into the global economy and strengthening their external position may hinge on transcending the residual colonial constructs to adopt development models that promote structural transformation and export diversification.

At the same time, economic diversification may be gender-equality enhancing in that it may foster women's economic empowerment by expanding opportunities for formal employment in the labor-intensive manufacturing and service sectors. Such a transformation could be a viable alternative to the informal economy whose remarkable growth over most of the post-colonial period has not been effective in lifting people out of poverty in the region. Future research will explore the implications of economic diversification for gender equality and women's economic empowerment.

³² See World Bank (2011).

³³ Most African countries are slated to miss the first Millennium Development Goal of halving poverty by 2015, despite the impressive boom in commodity prices over the last decade.

³⁴ See World Population Prospects, the 2010 Revision, United Nations, Population Division, Population Estimates and Projections, United Nations (2011).

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