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# Aid for Trade flows and Wage Inequality in the manufacturing sector of recipient-countries

Sèna Kimm GNANGNON<sup>1</sup>

## Abstract

The present article aims to contribute to the literature on the effectiveness of Aid for Trade (AfT) flows in recipient-countries by investigating the effect of these resource flows on wage inequality in the manufacturing sector of recipient-countries. The analysis has shown that AfT interventions help reduce wage inequality in the manufacturing sector of countries that liberalize their trade policies, enjoy greater trade openness, experience higher exports of labour-intensive, low-skill and high skill manufacturing products. Additionally, AfT interventions contribute to dampening the negative effect of export product concentration (for example on primary products) on wage inequality in the manufacturing sector. Finally, AfT flows reduce wage inequality in the manufacturing sector of countries that import manufacturing products (including machinery and transport equipment goods) or enjoy a greater extent of multilateral trade liberalization.

**Keywords:** Aid for Trade; Wage inequality in the manufacturing sector.

**Jel Classification :** F35; F13; F14; J3.

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## 1. Introduction

There is a voluminous literature on the determinants of income inequality in developing countries. However, despite the great importance of development aid flows for developing countries, few studies (e.g., Berrittella, 2017; Bjørnskov, 2010; Bourguignon et al. 2008; Calderon et al., 2009; Chao et al., 2010; Herzer and Nunnenkamp, 2012; Layton and Lielson, 2008; Pham, 2015; Younsi et al. 2019) have looked at the effect of development aid on income inequality in developing countries. Some of these studies have reported that development aid can widen income inequality in recipient-countries (e.g., Bjørnskov, 2010; Herzer and Nunnenkamp, 2012; Pham, 2015; Younsi et al. 2019), while others have found a weak effect of development aid flows on income inequality in developing countries (e.g., Calderon et al., 2009; Layton and Lielson, 2008). Bourguignon et al. (2008) have noted that development aid is equality enhancing. At the same time, a large body of the literature has looked at the determinants of wage inequality (including in the manufacturing sector) in developing countries. However, to the best of our knowledge, scarce studies<sup>2</sup> have considered the effect of development aid flows on wage inequality in the manufacturing sector of recipient-countries, let alone the effect of Aid for Trade (AfT) flows (which represents part of development aid dedicated to the development of the trade sector in developing countries) on wage inequality in the manufacturing sector of recipient-countries<sup>3</sup>. The desire to secure greater financial resources for promoting developing countries' participation in international trade has underpinned the launch of the AfT Initiative by the Members of the World Trade Organization (WTO) at the 2005 WTO Hong Kong Ministerial Conference. The genuine purpose of this Initiative is contained in Paragraph 57 of the Hong Kong Ministerial Declaration (WTO, 2005), which states that "Aid for Trade should aim to help developing countries, particularly LDCs, to build the supply-side capacity and trade-related infrastructure that they need to assist them to implement and benefit from WTO Agreements and more broadly to expand their trade". Yet, the initial intention of WTO Members when setting up the AfT Initiative was not to influence wages (including wages in the manufacturing sector, and thus wage inequality in this sector in the recipient-countries). However, AfT flows can genuinely affect wage inequality in the manufacturing sector of recipient-countries through its effects on several economic features of these countries, including trade policy (e.g., Gnanon, 2018a), manufacturing exports (e.g., Ghimire et al. 2013; Gnanon, 2018c, Hühne et al., 2014), and export product diversification (e.g., Gnanon, 2019b, 2019c; Kim, 2019).

The current analysis aims to contribute to the literature on the AfT effectiveness by exploring the effect of AfT flows on wage inequality in the manufacturing sector through these various channels. The analysis has been conducted using a sample of 65 AfT recipient-countries over the period 1996-2016. The empirical findings have shown that all these factors matter for the effect of AfT flows on wage inequality in the manufacturing sector of recipient-countries. The analysis has also shown that manufacturing imports (e.g., imports of machinery and transport equipment) and the extent of multilateral trade liberalization are key factors influencing the effect of AfT interventions on wage inequality in the manufacturing sector of recipient-countries.

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<sup>2</sup> One of these rare studies is that of Chao et al. (2010) who have shown that an increase in foreign aid may adversely affect on national welfare and widen the wage inequality between skilled and unskilled workers.

<sup>3</sup> Despite the important but still growing literature on the effectiveness of AfT flows (e.g., Cadot et al. 2014; Gnanon, 2020a; and OECD-WTO, 2017), there is to the best of our knowledge, no study on the effect of AfT flows on wage inequality in the manufacturing sector.

We organize the rest of the analysis as follows. Section 2 provides a theoretical discussion on how AfT flows can affect wage inequality in the manufacturing sector of developing countries through these channels. Section 3 lays down the model that can help explore empirically the issue, and Section 4 discusses the appropriate methodology for the empirical analysis. Section 5 presents some data analysis, and Section 6 interprets empirical outcomes. Section 7 concludes.

## **2. Theoretical discussion on the channels through which AfT interventions can affect wage inequality in the manufacturing sector**

This section discusses various channels through which AfT flows can affect wage inequality in the manufacturing sector of recipient-countries. These include trade policy liberalization (and trade openness), inward FDI, export of manufacturing products (and export product diversification). We discuss, in turn, each of these channels.

### ***2.1. Effect of AfT flows on wage inequality through trade policy liberalization (or trade openness)***

Gnangnon (2018a) has demonstrated empirically that AfT flows are associated with greater trade policy liberalization in recipient-countries. Therefore, we hypothesize that the effect of AfT flows on wage inequality in the manufacturing sector of recipient-countries can depend on the extent to which trade policy affects wage inequality. We first provide a literature review on the effect of trade liberalization (or trade openness) on wage inequality in the manufacturing sector of developing countries, and then briefly discuss how AfT interventions can affect wage inequality in the manufacturing sector through the trade policy channel.

The literature has analysed the effect of trade liberalization on wages inequality in developing countries from different perspectives, starting from the standard Heckscher-Ohlin (HO) and Stolper Samuelson (S-S) theories. The HO theory is based on restrictive assumptions, including perfect competition, perfect labour and capital mobility at least in the short-run, trade in final goods and fixed technology. The S-S theory relates factor prices to the changes in relative prices induced by trade. These theories predict that developing countries that open-up their economies to international trade (and thus experience lower trade costs) would enjoy a reduction in wage inequality between skilled and unskilled labour. This is because these countries are assumed to be relatively well endowed in unskilled labour, and therefore specialize in unskilled labour-intensive goods. By opening-up their economies to international trade, these countries would enjoy higher exports and prices of unskilled labour-intensive products, which would lead to a rise in the demand and wages of unskilled labour relative to skilled labour, and hence to the fall in wage inequality between skilled and unskilled workers. In other words, when a developing country integrates into the world trade market, the skill premium (the wage differential between unskilled and skilled workers) and wage inequality should fall. Some few studies have supported this theoretical prediction for the manufacturing sector. Rose (1987) has developed the theoretical argument that regulatory protectionism can generate rents, and higher wage premiums in the presence of workers' bargaining power. These wage premiums are reduced or totally eliminated as trade barriers are partially or completely removed, thereby making trade liberalization to be negatively associated with wage inequality as unskilled workers' relative income would deteriorate if unskilled labor intensive sectors experienced relatively higher tariffs prior to the trade reforms. Consistent with

this, Revenga (1997) (for Mexico) and Ghazali (2011) (for Tunisia) have shown that trade liberalization has reduced the rents captured by skilled labour, and led to a fall in the wage inequality between skilled and unskilled labour. Many other studies<sup>4</sup> have not confirmed the abovementioned theoretical prediction, i.e., trade liberalization (or trade openness) is associated with lower wage inequality. Those studies have rather found that many developing countries have experienced a rise in the wage inequality, despite having increased their integration into the global market (e.g., Goldberg and Pavcnik, 2004; 2007). Specifically, a relatively few studies have reported a positive association between trade policy protection and wage inequality (measured by industry wage premiums) in the manufacturing sector in developing countries. For example, Currie and Harrison (1997) have demonstrated theoretically and empirically that trade reforms have led exporters and highly affected firms to experience significant employment losses, even though on average, employment in the private sector manufacturing firms was unaffected. At the same time, low-paid workers were hired by parastatals. Other studies such as Feliciano (2001), Attanasio et al. (2004), Goldberg and Pavcnik (2005), Sen (2008) and Anwar and Sun (2012) have explained the positive wage inequality (between skilled workers and unskilled workers) effect of trade reforms by the fact that industries that were significantly affected by the trade reforms were highly intensive in unskilled labour. Thus, by enhancing competition and productivity<sup>5</sup>, trade liberalization has led to the decline of the price of goods of those unskilled labour-intensive industries, to a higher demand for skilled workers relatively to unskilled workers, and to a decline in the wages of unskilled labour. These have led to a widening of wage inequality between skilled and unskilled workers (see also Anwar and Sun, 2012; Galiani et al. 2003; Hanson and Harrison, 1999; Mishra and Kumar, 2005). Chaudhuri and Yabuuchi (2007) have emphasized the possible enhancing wage inequality effect of lowering import tariffs on low-skilled manufacturing sector in the presence of labour market imperfections.

Different other theoretical perspectives<sup>6</sup> (that have received empirical support) have emerged to reconcile the real-world evidence and the theoretical predictions of the Heckscher-Ohlin-Samuelson (HOS).

One perspective to explain the rise in wage inequality between low-skilled and high-skilled workers has been provided by the Feenstra and Hanson (1996, 1997) who have emphasized the role of intermediate products that can be imported from overseas (i.e., the 'outsourcing'). Feenstra and Hanson (1996) have developed a model in which activities highly intensive in unskilled workers are outsourced from the North to the South, the latter being considered as a relatively skill-poor country and where low-skilled labour is comparatively cheaper (see also Feenstra and Hanson, 2011). The North would experience a fall of low-skilled workers' wages relatively to wages of high-skilled workers, due in particular to the decrease in the demand for low-skilled labour in the North. It would follow a rise in the wage inequality between skilled and unskilled workers. On the other hand, the outsourcing (from the North to the South) of the segment of the production

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<sup>4</sup> Goldberg and Pavcnik (2007) have provided a literature review of the studies concerning the effect of trade liberalization on wages and inequality in developing countries.

<sup>5</sup> This aligns with the theoretical argument that productivity enhancement at the firm-level due to the greater competition induced by trade liberalization can translate into higher industry wages (e.g., Helpman and Krugman, 1989).

<sup>6</sup> Harrison et al. (2011) have provided a survey on many mechanisms through which trade can affect and usually results in higher income inequality. It is noteworthy that Institutional factors, including rigidities in the labor market represent another perspective on the relationship between trade and wage inequality (e.g., Topalova, 2010).

work that is intensive in low-skilled workers, corresponds to a high-skilled production work in the South (i.e., developing countries). This would yield an increase in the demand for skilled labour in developing countries, and an increase in wage inequality in developing countries. Ebenstein et al. (2014) have also reported a positive effect of trade and offshoring on wage inequality for American workers.

Another perspective has relaxed the fixed technology assumption in the HOS prediction, and considered technology as not exogenously given for a country. Greater trade liberalization (or trade openness) could change a country's technological orientation (e.g., Wood, 1995), including through higher imports of goods that embedded advanced knowledge and technology, as well as through capital inflows (e.g., Acemoglu, 2003). As a consequence, the technology changes induced by greater participation in international trade will increase the demand for more skilled labour at the expense of unskilled (or low-skilled) labour. Wages for high-skilled labour would increase relatively to the those of unskilled (or low-skilled) labour, thereby leading to a rise in the wage inequality between skilled and unskilled labour. This is referred to as the skilled-bias technological change (SBTC) argument to explain the rising wage inequality between skilled and unskilled labour. While many studies<sup>7</sup> have provided empirical support for the SBTC theory<sup>8</sup> for developed economies (see for example, Lee and Wie, 2015 for a literature review), some other studies have reported a positive association between technological changes and wage inequality in developing countries. These include Berman et al. (2005) and Kijima (2006) for India; Bustos (2011) for Argentina; Chen et al. (2010) for China; Harrison (2008) for Brazil and India; Hahn and Choi (2017) for Korea, and Lee and Wie (2015) for Indonesia, and Martorano and Sanfilippo (2015) for Asian countries. Additionally, Berman and Machin (2000) have observed that Skill-biased technology transfer has contributed to the rise in the demand for skilled workers in middle-income countries, but less so in low-income countries. Gourdon (2011) has provided empirical evidence that South-South trade liberalization has led to a higher bias of technological change toward skill-intensive sectors compared to North-South trade liberalization, and to a higher wage inequality in developing countries, with this effect being more important in low-income countries. Zhu and Trefler (2005) have shown that technological catch-up by developing countries have induced the migration of the production of the least skill-intensive Northern goods to developing countries, where these goods become the most skill-intensive products. These have widened the wage inequality in both the developing and developed countries.

The South-South trade argument has also been put forward to explain wage inequalities in developing countries, given the substantial increase in South-South trade since the 1980s. The emergence of many developing countries (such as China) with a large pool of unskilled labour force has enhanced competition among developing countries in the context of South-South trade, and resulted in a decline in the products prices and low-skilled labour rewards in these countries. It has therefore followed a widen of the wage gap between skilled and unskilled workers in developing countries. Davis (1996) has developed a theoretical framework on the effect of trade

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<sup>7</sup> Nevertheless, Card and DiNardo (2002) have pointed out that non-market factors (e.g., minimum wage, labour unions) have much more important than technological changes in explaining rising wage inequality. They have considered technological change as an episodic event, and not a secular trend.

<sup>8</sup> Feenstra and Hanson (1999) have shown that offshoring (by 25%) and technological change (by 30%) have explained the increase in the relative wage of non-production workers in the United States over the period 1979-1990.

liberalization on factors' rewards within different groups of countries that have similar endowments. The author has underlined the need for differentiating between different types of developing countries so as to obtain clear results on the wages effects of trade liberalization: how a country is positioned amongst other countries within its own cone of diversification is key, in that respect. Gourdon (2011) has reported empirical evidence that trade liberalization in the context of South-South trade, has contributed to a greater wage inequality in middle-income developing countries than the North-South trade liberalization in the context of North-South trade.

On the basis of this literature review, we postulate that the direction of the effect of AfT flows on wage inequality would depend on how trade policy affects wage inequality. Despite the lack of consensus in the literature, one might be tempted to conclude that trade policy liberalization would result in greater wage inequality in the manufacturing sector of developing countries, even though this issue remains an empirical matter. We postulate that as AfT flows are associated with greater trade policy liberalization, these inflows could result in higher (lower) wage inequality in the manufacturing sector of developing countries depending on whether trade policy liberalization induced itself higher (lower) wage inequality in this sector. At the same time, AfT interventions contribute to addressing the structural constraints<sup>9</sup> that prevent recipient-countries from genuinely participating in, and taking fair advantages of international trade. Thus, these inflows would not only enhance the competitiveness of existing small and medium enterprise (SMEs), but also promote the emergence of new SMEs, thereby providing opportunities for the development of self-employment, and allowing previously unemployed or underemployed workers to now receive income (or wage). In light of the important reservoir of less-skilled unemployed workers in many developing countries, the employment generated by AfT flows (e.g., Gnanon, 2018b; 2019a) could help reduce wage inequality between high-skilled and low-skilled workers, including in the context of greater trade policy liberalization. On another note, if AfT flows promote technological changes in recipient-countries thanks to greater trade liberalization, they can eventually lead to a widening of wage inequality in the manufacturing sector of recipient-countries, in light of the positive wage inequality effect of SBTC. However, AfT flows (in particular AfT for trade policy and regulation) can help mitigate the adverse effect of trade-induced technological changes by compensating workers and firms for the social dislocation induced by the enhancement of competition associated with greater trade liberalization (e.g., OECD, 2010). In this scenario, AfT flows would be associated with lower wage inequality as countries further liberalize their trade regimes.

## ***2.2. Effect of AfT flows on wage inequality through exports, including manufacturing exports***

Recent theories have examined how international trade affects wage inequality by relying on the heterogeneous firm trade model developed by Melitz (2003), and incorporating therein firms and workers' heterogeneity as well as labor market imperfections. Wage inequality has been envisaged here as the wage gap between exporters and non-exporters. For example, Egger and Kreickemeier (2009) have developed a heterogeneous-firm trade model where imperfections of

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<sup>9</sup> Structural constraints are addressed through including through improvement of the business environment, better access to finance, and support for seizing opportunities in the international market see ITC/WTO (2014); OECD/WTO (2015) and OECD/WTO (2019).

the labor market have been accounted for through a fair wage effort mechanism. This model considers that workers accord a special importance to getting 'fair wages', which depend on the economic success of the firm where they are working. Thus, workers expect to receive higher wages as the firm in which they work become more productive and profitable, so that in the equilibrium, exporting firms that are more productive than non-exporting firms would pay higher wages. Overall, in this framework, wages differ from firm to firm, and can fuel wages inequality. Helpman et al. (2010) have developed the Melitz-type model (see Melitz, 2003) by including therein searching and matching frictions as well as employer screening, so as to explain the relationship between trade and wage inequality. In this setting, employed workers can bargain for a share of profits because hiring costs prevent workers outside a firm from perfectly substituting for workers currently being employed in the firm. Therefore, ex-ante, workers are homogenous, but benefit from a firm-specific ability bonus. The incentives for firms to screen workers arises from the complementarities between abilities of employees and the productivity of the firm in which they are working. Thus, more productive exporting firms would select for export by strengthening their monitoring of workers, and retaining those workers with higher average ability. They would pay higher wages to those workers since it is costly to replace higher-ability employees. In this context, greater trade liberalization would incentivize more productive firms to export and intensify their monitoring of workers. As a consequence, exporting firms would pay higher wages than non-exporting firms because they likely have workforce with higher average ability.

As a matter of fact, the existence of an exporter wage premium dates back to the seminal work by Bernard and Jensen (1995, 1997), which has received strong empirical support<sup>10</sup> in the literature. Bernard and Jensen (1997) have considered the case of the United States in the 1980s and shown that the rise in wage inequality in the US manufacturing has been attributed to the relative rise in the labour demand by exporting firms, which compared to non-exporting firms, employ more highly-skilled workers than lower-skilled workers. The rise in the wage inequality between skilled workers and lower-skilled workers is due to the expansion of exporting firms, which demand a relatively higher number of higher-skilled workers compared to low-skilled workers. This enhancing wage inequality effect of manufacturing exports' expansion can be further strengthened if exporting firms compensate skill groups differently compared to domestic firms, and particularly if they pay a higher export wage premium to high-skilled workers compared to low-skilled workers. A number of studies have also illustrated the existence of employment premium<sup>11</sup> associated with exporting because exporting firms are usually larger employers of a higher number of employees than non-exporting firms (e.g., Bernard and Jensen, 1999, Brambilla et al. 2015; Serti et al. 2010). Additionally, exporting firms reward their workers with higher wages (including through a premium, see Brambilla et al. 2015), especially if they enjoy higher profits (e.g., Brambilla et al. 2012; Amiti and Davis 2012; Baumgarten 2013). Nonetheless, Kong et al. (2018) have used Chinese firms and obtained that higher exports are positively associated with higher average wages of firms. However, only top managers - including those that have overseas work experience - enjoy a wage premium, and only employees with high educational level receive significant wage premiums (other employees do not benefit from a wage premium). Matthee et al.

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<sup>10</sup> See for example, Schank et al. (2007) for a literature review on this matter.

<sup>11</sup> For firms, including manufacturing ones, see studies such as Aw and Hwang (1995) (for Taiwan), Bernard and Wagner (1997) (for Germany), Blalock and Gertler (2004) (for Indonesia), Isgut (2001) (Colombia), Turco and Maggioni (2013) (for Turkey) and, Bigsten et al. (2004), Rankin et al. (2006), Van Biesebroeck (2005) for Africa.



(2017) have concluded that there exist a large wage inequality among exporting firms in the manufacturing sector of South Africa (even relatively to non-exporting firms), and that this inequality is not primarily explained by exporting but rather by the characteristics associated of the different firms that operate in the export market. The wage inequality - associated with exporting activities or different types of employment between these activities - within different levels of skills, i.e., between highly skilled workers and low-skilled workers has been illustrated for example by Alvarez and López (2005), Bustos (2011), Klein et al. (2013), Tsou et al. (2006), Van Biesebroeck, 2005). Bas (2012) has used data of Chilean firms operating in the manufacturing sector to demonstrate that exporters that are in the upper range of exporters' productivity distribution tend to use high technology and high-skilled workers than do exporters on the lower range of the distribution. As AfT flows can be associated with higher employment levels (e.g., Gngangnon, 2018b) as well as greater employment diversification (e.g., Gngangnon, 2019a), we can expect higher AfT flows to be associated with higher employment premium. This can, in turn, result in lower wage inequality between high-skilled workers and low-skilled (or unskilled) workers, depending on whether or not AfT interventions are associated with higher employment of low-skilled (or unskilled) workers relatively to high-skilled workers in the manufacturing sector.

One can also expect that as AfT flows can promote manufacturing exports in recipient-countries (e.g., Ghimire et al. 2013; Gngangnon, 2018c, Hühne et al., 2014), they can widen wage inequality in the manufacturing sector in the recipient-countries. However, in reality, the effect of AfT flows on wage inequality in the manufacturing sector in recipient-countries would depend on the degree of the manufacturing of export products. Indeed, Hühne et al. (2014) have used the Standard International Trade Classification (SITC) categories of exported products, and reported evidence of a positive effect of AfT flows on different categories of SITC manufacturing export products. Interestingly, Gngangnon (2018c) has used a panel dataset of 121 countries over the period 2002-2015 to show empirically that, on average, AfT flows have exerted a positive effect on exports of low-skilled and technology-intensive manufactures, as well as high-skilled and technology-intensive manufactures (relatively to total primary export products). However, there was no significant effect of AfT flows on recipient countries' exports of medium-skilled and technology-intensive manufactures. The picture is, however, slightly different for LDCs: they have enjoyed a positive effect of AfT flows on exports of low-skilled and technology-intensive manufactures, but a negative one on exports of medium-skilled and technology-intensive manufactures, and exports of high-skilled and technology-intensive manufactures. Therefore, we can expect AfT flows to induce a relatively higher demand for low-skilled workers (and eventually a relatively higher wages of these workers) if these capital flows are associated with a rise in exports of low-skilled and technology-intensive manufactures compared to other manufacturing products. This signifies that AfT interventions would reduce the wage gap between low-skilled workers and high-skilled workers in countries that experience a rise in low-skilled and technology-intensive manufactures exports<sup>12</sup>. This argument is particularly relevant when AfT flows serve to rebuild a shrinking manufacturing sector, as in such as case, the level of unemployment rises and the level of employment declines (e.g., Autor et al., 2015; Charles et al., 2019), leading to a reduction of the relative wages of workers at the low end of the income distribution (e.g., Gould, 2018). The same

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<sup>12</sup> This argument is plausible for the case of developing countries, given the bulk of low-skilled workers in these countries.

effect might be expected for medium-skilled workers. However, AfT interventions could be associated with higher wage inequality between low-skilled (eventually medium-skilled) workers and high-skilled workers, if they resulted in higher exports of high-skilled and technology-intensive manufactures. This is because the expansion of this type of manufacturing exports would drive the demand for high-skilled workers relatively to lower-skilled workers, and widen the wage inequality between these types of workers.

Similarly, as AfT flows can be associated with greater export product diversification in recipient-countries (e.g., Gnanon, 2019b, 2019c; Kim, 2019), we can expect that these inflows would help increase the relative wages of low-skilled workers compared to skilled workers if they were associated with export product diversification towards light manufacturing products, i.e., manufacturing products that are low-skill and technology intensive. In contrast, if AfT interventions were associated with greater export product diversification towards high-skilled and technology-intensive manufactures, then they could drive the demand for high-skilled workers (and consequently induced a relatively higher wage for those workers), and lead to a higher wage inequality in the manufacturing sector. This is consistent with the strand of the literature that has shown that product quality and destination of country characteristics matter for the wages and type of workers employed by firms. For example, Verhoogen (2008) have demonstrated (by providing an illustration for the Mexican case) that the production of higher-quality goods requires higher quality workers within each occupational category, and those workers must receive higher wages. The author has then explained that as higher incentives to export in a developing country is associated with differential quality upgrading, more productive plants would initially increase exports, produce a higher share of higher-quality goods, and raise wages compared to initially less productive plants in the same industry. This process would lead to a wage dispersion within the industry because firms that were initially more productive would tend to pay higher wages. Bernard et al. (2009) have used data on the United States manufacturing sector, and shown that exporters of multiple products to multiple destinations employ more (skilled) workers and pay higher wages than those that those that rely on a single product or single destination. The study by Brambilla et al. (2012) on Argentina, supported by the work by Brambilla and Porto (2016) over 82 countries, have found that export destinations tend to be 'skill-biased', whereby exporting (likely higher-quality products) to high-income countries involves a relatively higher demand for skilled workers, and thus a relatively higher wage to those workers, compared to exporting to middle-income countries or selling in the domestic market. This implies that exporting higher-quality goods is associated with a higher wage inequality between high-skilled workers and low-skilled workers. Along the same lines, Rankin and Schöer (2013) have uncovered empirically for South Africa that domestic producer or firms that export to the regional (i.e., the South African Development Community - SADC - market) (whose real per capita incomes are lower than those of the international market) tend to pay lower wages to their workers compared to firms that export to the international market. According to the authors, this difference in wages is explained by the existence of a premium that different types of exporters pay for various skills levels. Matthee et al. (2016) have provided empirical support to the findings by Rankin and Schöer (2013). However, using manufacturing firms data of Sub-Saharan African firms, Milner and Tandraven (2007) have found slightly different results. They have reported, on the one hand, that workers' wages are associated with firms' export status, and there exists skill premium associated with firms' exporting. On the other hand, and in contrast with the findings by Matthee et al. (2016) and Rankin and

Schöer (2013), Milner and Tandrayen (2007) have observed that firms that export to the African markets pay a higher wage to their workers, while a negative wage premium is associated with exporting outside the African market. The authors have explained these findings by the existence of a disciplining effect on the wages paid by exporting firms only if the latter export to more competitive markets.

### ***2.3. Effect of AfT flows on wage inequality through inward FDI***

The few existing studies (e.g., Lee and Ries, 2016; Ly-My and Lee, 2019) on the relationship between AfT flows and foreign direct investment (FDI) inflows have reported a positive effect of the former on the latter. Lee and Ries (2016) have obtained that total AfT flows, in particular AfT for trade-related infrastructure and AfT for building productive capacity, are positively associated with greenfield investment. Ly-My and Lee (2019) have reported a positive FDI inflows effect of AfT flows, and additionally that AfT interventions help diversify greenfield FDI projects. On the other side, Selaya and Sunesen (2012) have emphasized that aid allocated for example to the build-up of public infrastructure generates higher FDI inflows, while aid invested in physical capital transfers (i.e. directed towards productive sectors such as agriculture, manufacturing, banking,..etc) crowds out FDI inflows. Dong and Fan (2017) have shown, inter alia, that China's aid in the form of social and economic infrastructure crowds in FDI inflows from China to African countries, while aid allocated to the development of the productive sector crowds out FDI flows from China to African countries.

On the other hand, FDI inflows can affect wage inequality between skilled and unskilled labour in the manufacturing sector through many avenues<sup>13</sup>, including for example innovation (introduction of new technologies/technology transfer in the host country), higher productivity and employment. Figini and Görg (2011) have used a sample comprising developed and developing countries and obtained over the entire sample that there exist a non-linear effect of FDI inward stock on wage inequality in the manufacturing sector. This non-linear effect has been found to be robust for developing countries, but not for developed countries. With respect to developing countries, wage inequality in the manufacturing sector rises with FDI inward stock, but diminishes with further FDI stock. Chen et al. (2011) have used data on enterprises in the Chinese manufacturing sector, and reported that higher FDI has increased the inter-enterprise wage inequality. Suanes (2016) has observed empirically, over 13 Latin American economies that FDI in the manufacturing sector has exerted a positive effect on income inequality. As wage represents a significant share of personal income for the great majority of people, we could expect that the latter finding can be extended to wage inequality. Using data on Chinese industrial enterprises, Chen et al. (2017) have reported that through their effect on labour transfer and technology spillovers, FDI inflows in China have contributed to reducing the wage gap between foreign firms and domestic firms in China.

Against this background, we expect that as AfT interventions can be associated with higher FDI inflows in the recipient-countries, these interventions can result in a higher wage inequality in the manufacturing sector through the relatively higher demand for high-skilled workers. However, as the positive wage inequality effect of FDI decreases as FDI stock rises in developing countries

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<sup>13</sup> See for example, Figini and Görg (2011) and Peluffo (2015) for a literature review on the effect of FDI inflows on income inequality, and particularly wage inequality.

(Figini and Görg, 2011) or as FDI may help reduce the wage gap between foreign firms and domestic firms in the host-country (Chen et al. 2017), we can expect that AfT flows would be associated with lower wage inequality in the manufacturing sector as FDI further rises. Summing-up, the extent to which the effect of AfT flows on wage inequality in the manufacturing sector in recipient countries depends on the size of FDI to these countries is an empirical matter.

### 3. Empirical model

We investigate empirically the effect of AfT flows on wage inequality in the manufacturing sector of recipient-countries by drawing primarily from the study by Figini and Görg (2011), but also from that of Martorano and Sanfilippo (2015). We consider a model specification that includes not only the variable of key interest (the AfT flows), but also three control variables that could potentially affect the influence of AfT flows on wage inequality in the manufacturing sector in recipient-countries. These controls include the education level (which acts here as a proxy for the level of human capital accumulated) denoted "EDU"; the inflation rate, denoted "INFL"; and the real per capita income, denoted "GDPC". These three variables have been described in Appendix 1. It is important to note that other key determinants of wage inequality in the manufacturing sector such as trade liberalization (or trade openness), inward FDI flows (or stock), or technological development have not been included in the baseline model because as discussed above, they represent the channels through which AfT interventions can affect wage inequality in the manufacturing sector. In the empirical analysis, we examine whether these factors genuinely represent channels through which AfT flows affect the wage inequality variable. Following Figini and Görg (2011) and Martorano and Sanfilippo (2015), the education variable have been included in the model in order to control for the supply-side of the labour market, i.e., the relatively endowment of skilled labour. We expect that a higher education level would increase the relative supply of skilled labour and reduce wage inequality (e.g., Figini and Görg, 2011; Lankisch et al., 2019). However, a rise in the education level might also reflect an inequality in education across workers. In this case, a higher education level can be associated with higher wage inequality, as high-skilled workers are better rewarded than lower-skilled workers (e.g., Broecke et al., 2017). Many studies have documented the existence of a positive association between inflation and income inequality on the ground that inflation can erode the values of real wages, influence disproportionately income inequality, and increase income inequality (e.g., Albanesi, 2007; Bulř, 2001; Coibion et al. 2017; Lundberg and Squire, 2003). However, there is still no consensus on the direction of the effect of inflation on income inequality. For example, Chu et al. (2019) have demonstrated the existence of an inverted-U effect relationship between inflation and income inequality. However, Zheng (2020) has shown that inflation that reduces economic growth can mitigate income inequality by dampening the contribution of asset income relative to wage income. Against this background, and given that wages contribute significantly to the personal income of the majority of people in developing countries, we conclude that the effect of inflation on wage inequality in the manufacturing sector can be positive or negative, and is therefore, an empirical issue. Finally, the introduction of the real capita income variable in model (1) aims to capture countries' development level, and ensure that the effect of AfT flows on wage inequality in the manufacturing is not capturing that of the real per capita income (see a similar argument by Figini and Görg, 2011; see also Sbardella et al. 2017).

We postulate the following model:

$$WINEQ_{it} = \alpha_0 + \alpha_1 WINEQ_{it-1} + \alpha_2 AfT_{it} + \alpha_3 GDP_{it} + \alpha_4 EDU_{it} + \alpha_5 INFL_{it} + \mu_i + \vartheta_t + \omega_{it} \quad (1)$$

where the subscripts  $i$  and  $t$  are respectively a country's index and the time-period. The panel dataset contains 65 countries over the period 1996-2016. The panel dataset has been built based on data availability. In particular, we have used non-overlapping sub-periods of 3-year average data to mitigate the effects of business cycles on variables contained in model (1). These sub-periods are 1996-1998; 1999-2001; 2002-2004; 2005-2007; 2008-2010; 2011-2013 and 2014-2016. The coefficients to be estimated are  $\alpha_0$  to  $\alpha_5$ .  $\mu_i$  represent countries' specific effects, and  $\vartheta_t$  are time dummies that reflect global shocks affecting the manufacturing sector wages (hence the wage inequality) in all countries together.  $\omega_{it}$  is an idiosyncratic error-term. The introduction of the one-period lag of the dependent variable as a regressor in model (1) aims to capture the inertia in the index of wage inequality in the manufacturing sector. This inertia may arise from the lagged effects of the explanatory variables on wage inequality, and taking it into account in the model allows for differentiating between short-run effect and long-run effect of explanatory variables on wage inequality in the manufacturing sector.

The dependent variable "WINEQ" represents the wage inequality in the manufacturing sector. It is the Theil index of wage inequality computed for each country and every year, over the period 1996 to 2016. Following Figini and Görg (2011), we have used a measure of general wage inequality between sectors and between workers, rather than a measure of the gap between wages of skilled and unskilled workers, such as the one used for example by Martorano and Sanfilippo (2015). The Theil index of wage inequality has then been computed using the United Nations Industrial Development Organization (UNIDO)'s country-year data on the average wages per employee across 3-digit International Standard Industrial Classification (ISIC) manufacturing industries, which is weighted by the number of employees in each sector.

The variable "AfT" represents the real gross disbursements of AfT flows. In the analysis, total AfT flows (denoted "AfTTOT") is our main measure of AfT flows, but we have also used two components of total AfT flows (the sum of these two components amounts to total AfT flows). These include the real gross disbursements of AfT flows allocated to the industry sector (denoted "AfTIND") and the real gross disbursements of AfT allocated to all other sectors than the industry sector (denoted "AfTNONIND"), both components being expressed in constant prices 2016 (US Dollar). In principle, data on the gross disbursements of AfT flows contained in the OECD database run from 2002 onwards. However, for the present study, we have expanded (back to 1996) this database to the period 1996-2016 to obtain a higher number of observations, and potentially medium-term effects. We do so by following the approach proposed by Clemens et al. (2012), Thiele et al. (2006) and Selaya and Sunesen (2012) (see Appendix 2 for the description of this approach) and also recently used by Gnanon (2020b).

To avoid experiencing units of measurement concerns when interpreting and comparing results arising from estimations of model (1) and its different variants, we have standardized all five variables contained in model (1), as well as all other variables (e.g., trade policy, trade openness, FDI, .....etc), which are the channel-variables through which total AfT flows can affect wage inequality in the manufacturing sector. By standardizing all variables, we do not include time

dummies in the regressions, as their standardized values are equal to zero. The standardization procedure involves calculating for each variable, the ratio of the difference between the concerned variable and its mean (average) to the standard deviation of this variable. The coefficients arising from regressions based on standardized variables (standardized coefficients) could be easily compared and ranked in terms of their contribution to explaining the dynamics of wage inequality in the manufacturing sector. We report in Appendices 3a and 3b, the standard descriptive statistics respectively on unstandardized (i.e., normal) variables as well as standardized variables. Appendix 4 presents the list of the 65 countries used in the analysis.

#### **4. Estimation technique**

We estimate model (1) or its different variants (presented below) by means of the two-step system Generalized Methods of Moments (GMM) estimator, which is suitable for dynamic panels with a small-time dimension and large cross-section (see Arellano and Bover, 1995 and Blundell and Bond, 1998). This estimator (also used by Figini and Görg, 2011) has been chosen in light of its advantages in better handling a number of endogeneity concerns compared to other estimators such as the first difference GMM approach. First, by taking into account the inertia in wage inequality in the manufacturing sector (in model (1)), we introduce a correlation between the one-period lag of the dependent variable and countries (unobservable) specific characteristics. This correlation leads to biased and inconsistent estimates (known as Nickell bias, see Nickell, 1981) because the time dimension of our panel dataset is small and the cross-section dimension relatively large. Second, regressors in model (1) capturing AfT flows, the education level and the real per capita income are potentially endogenous due to the reverse causality and simultaneity bias. Given the limited number of countries in the sample, and to avoid the proliferation of instruments used in the regressions, the inflation variable is considered as exogenous, but results do not change when we considered it as endogenous. The exogeneity of this variable rests on the absence of a reverse causality from the dependent variable to the inflation variable, simply because given the relatively small size of the manufacturing sector in many developing countries (the public sector is the main job providers in many developing countries, including least-developed ones). As a result, it is unlikely that wage inequality (eventually due to the rise of the relative wage of skilled workers compared to unskilled workers) would fuel inflation in these countries. Third, the system GMM estimator helps overcome the endogeneity problem arising from the omitted variable bias. The two-step system GMM approach involves the estimation of a system of equations (i.e., equations in level and in differences) where lagged values are used as instruments for the first-differenced regressors, and first differences as instruments for the equation levels. In principle, estimates arising from regressions based on the two-step system GMM are fully consistent if the null hypotheses of the Arellano-Bond test of first-order serial correlation in the error term (denoted AR(1)) and no second-order autocorrelation in the error term (denoted AR(2)) are not rejected; and if the Sargan test of over-identifying restrictions (OID) - which determines the validity of the instruments used in the estimations - generates p-values higher than 0.10 (at the 10% level). We additionally present the Arellano-Bond test of no third-order serial correlation in the error term (denoted AR(3)), as failure to reject the null hypothesis might reflect a problem of omitted variable(s). Finally, these tests are powerful if the number of instruments is lower than the number of countries (Bowsher, 2002; Roodman, 2009; Ziliak, 1997). To meet this rule of thumb, we have

used a maximum of 3 lags of dependent variable as instruments and 3 lags of endogenous variables as instruments in the two-step system GMM-based regressions.

Against this background, the following specifications of model (1) are estimated over the full sample of 65 countries<sup>14</sup> over the period 1996-2016. We first present in Table 1 the outcomes of the estimations of model (1) (as it stands), including by using "AfTTOT" as the measure of the variable "AfT" (see column [1] of the Table) or alternatively its components highlighted above (see column [2]). Column [3] of Table 1 contains the outcomes of the estimation of a variant of model (1) that includes the interaction between the total AfT flows variable and the real per capita income variable. These outcomes serve to examine the extent to which the effect of total AfT flows on wage inequality in the manufacturing sector varies across the 65 countries in the entire sample, based on their real per capita income.

Results in Table 2 allow examining how total AfT flows affect wage inequality in the manufacturing sector through the trade liberalization (trade openness) channel. These results are obtained from estimating three different variants of model (1) that include a variable capturing trade liberalization/trade openness, as well as its interaction with the total AfT flows variable. Three alternative trade policy/trade openness variables have been used in the analysis. The first variable is the trade policy index (de Jure measure of trade policy) – that is, the score of freedom to trade internationally - developed by the Heritage Foundation (see Miller et al., 2019). This variable, denoted "DTP" is a composite index of the absence of tariff and nontariff barriers that affect imports and exports of goods and services. Higher values of "DTP" indicate lower trade barriers, i.e., greater trade policy liberalization. The second measure (denoted "OPEN") is the standard measure of trade openness (i.e, de facto trade openness) measured by the sum of exports and imports, expressed in percentage of GDP. The third measure is also a de facto indicator of trade openness (denoted "OPENSW"), and has been proposed by Squalli and Wilson (2011). It is computed by weighing the standard measure of trade openness ("OPEN") by the proportion of a country's trade level relative to the average world trade (Squalli and Wilson, 2011). This indicator, more than the standard trade openness measure, genuinely reflects countries' level of integration into the international trade market.

We display in Table 3, the results of the estimations of different other specifications of model (1) that allow assessing the extent to which the effect of total AfT flows on wage inequality in the manufacturing sector depends on the size of inward FDI to the AfT recipient-countries. These specifications of model (1) include a variable measuring the size of FDI and its interaction with the total AfT flows variable. Specifically, we use two main measures of the size of FDI (that is, in terms of flows and in terms of stock) expressed in real values and in percentage of GDP (of the AfT recipient-countries): these include the total inward FDI stock and the net FDI inflows. The estimations' outcomes displayed in Table 4 allow examining how the effect of total AfT flows on wage inequality in the manufacturing sector passes through countries' manufacturing exports. To that end, we estimate different specifications of model (1) that include a variable measuring countries' manufacturing export performance, and its interaction with the total AfT flows variable. Manufacturing export performance has been measured either by the share of total manufacturing exports products in total export products (denoted "MANEXP"), as well as the components of

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<sup>14</sup> We would like to note here that the exclusion from the sample of countries such as Republic of Korea (that was previously a recipient of AfT) does not change quantitatively and qualitatively the empirical outcomes of the analysis.

the latter. These components include the total export products share (%) of: labour-intensive and resource-intensive manufactures exports (denoted "LABEXP"); Low-skill and technology-intensive manufactures exports (denoted "LOWEXP"); Medium-skill and technology-intensive manufactures exports (denoted "MEDEXP"); and High-skill and technology-intensive manufactures exports (denoted "HIGHEXP"). We also complement this analysis by assessing the extent to which the effect of total AfT flows on wage inequality in the manufacturing sector depends on recipient-countries' level of export product diversification. To do so, we estimate a variant of model (1) that includes both a variable measuring the level of export product concentration (denoted "ECI") (whose inverse reflects export product diversification) and the interaction of this variable with the total AfT flows variable. The outcomes of this estimation are also provided in Table 4.

We also investigate the extent to which the effect of AfT flows on wage inequality in the manufacturing sector depends on the imports of different types of manufacturing goods. Such estimations help capture whether there eventually exist a SBTC effect of AfT flows through imports of products that incorporate technology and knowledge and that can translate in technological progress in the importing countries (that are AfT recipient-countries). To perform this analysis, we estimate different other specifications of model (1) in which we introduce an indicator capturing the import of manufacturing products, along with its interaction with the total AfT flows variable. This indicator can be the total import products share (%) of: total manufacturing imports (denoted "MANIMP"); Medium-skill/and High-skill and technology-intensive manufactures imports (denoted "MEDHIGHIMP"); and Machinery and transport equipment imports (denoted "MACHIMP"). The results of these various estimations are provided in Table 5.

Finally, we deepen the analysis by considering whether the effect of total AfT flows on wage inequality in the manufacturing sector depends on the potential degree of multilateral trade liberalization that an AfT recipient-country can enjoy (when acceding to the international trade market). We carry out this analysis by estimating a specification of model (1) that includes an indicator of multilateral trade liberalization, and its interaction with the total AfT flows variable. Results of the estimation of this specification of model (1) are presented in Table 6. Following for example, Ratnaik (2012) and Gnanon (2017a,b; 2018d; 2019d,e), we define multilateral trade liberalization as 'all trade-related decisions - including those adopted at the multilateral level under the ambit of the WTO - that ultimately contribute to the reduction of tariffs and non-tariffs barriers to trade by all countries, or at least by the overwhelming majority of countries.' In practice (i.e., for the empirical analysis), multilateral trade liberalization has been defined as the average 'domestic' trade policy of the rest of the world. Thus, it is for a given country, the average of the score of freedom to trade internationally (the indicator "DTP" defined above) of the rest of the world. Multilateral trade liberalization lowers tariffs and non-tariffs barriers on products exported by countries, including developing ones. In particular, it contributes to reducing tariffs peaks and tariffs escalations that prevent developing countries from adding significant value to their export products, and diversify their export product basket. The positive export product diversification effect of multilateral trade liberalization has been reported by Gnanon (2019d). Beverelli et al. (2015) have also demonstrated that the WTO's (multilateral) Trade Facilitation Agreement can help countries diversify their export products basket both at the extensive margins (i.e., by increasing the number of products exported by destination) and in terms of the number of export



destinations. Gnangnon (2017a) has also shown that multilateral trade liberalization is an important driver of FDI inflows. In light of these, we expect multilateral trade liberalization to affect wage inequality through the export product diversification and inward FDI channels (see the discussion in Section concerning how these two factors influence wage inequality in the manufacturing sector). As AfT flows also affect wage inequality in the manufacturing sector through these two channels, both AfT interventions and multilateral trade liberalization may reinforce each other (or be substitutable) in influencing wage inequality in the manufacturing sector. Hence, AfT flows can lead to lower wage inequality in the manufacturing sector in the context of greater multilateral trade liberalization, or widen wage inequality as countries enjoy greater multilateral trade liberalization depending on the direction in which export product diversification and inward FDI influence wage inequality in the manufacturing sector. The issue is therefore purely empirical.

## 5. Data analysis

Before turning to interpreting empirical results, it can be useful to get a first insight into the correlation between (unstandardized) AfT flows (including both total AfT flows as well as AfT flows allocated to the industry sector and AfT flows for other sectors) and wage inequality in the manufacturing sector. We present in Figure 1 the developments of these indicators over the panel dataset under analysis, using their average values. Figure 2 shows the correlation between total AfT flows and the wage inequality using both unstandardized and standardized values (see respectively the left-hand side and the right-hand side graphs in Figure 2). Figure 1 shows an erratic evolution of wage inequality, including in an opposite direction to AfT flows variables. The three AfT flows variables have rather moved in the same direction. In particular, they have significantly declined from 1996-1998 to 2002-2004, and subsequently increased over the rest of the period, although during the last sub-period, AfT flows to the industry sector have declined. These positive movements of AfT flows after 2004 certainly reflect the positive AfT Initiative effect. Interestingly, AfT flows dedicated to the non-industry sectors represent an important share of total AfT flows. Total AfT flows, AfT flows for the non-industry sectors, and AfT flows allocated to the industry sector amounted respectively to US\$ 411.8 million, US\$ 398 million and US\$ 27.2 million in 1996-1998, against US\$ 129.3 million, US\$ 121 million, and US\$ 8.34 million in 2002-2004. Both total AfT flows and AfT for non-industry sectors reached respectively US\$ 347.2 million and US\$ 326 million in 2011-2013, while on this sub-period, AfT flows for the industry sector represented only US\$ 21 million. Finally, in 2014-2016, both total AfT flows and AfT for non-industry sectors reached respectively US\$ 399.1 million and US\$ 387 million, while AfT for the industry sector amounted to US\$ 11.8 million (against US\$ 21 million in 2011-2013). Concerning Figure 2, we note that an unclear direction of the correlation pattern between total AfT flows and wage inequality in the manufacturing sector in the two graphs displayed in Figure 2. Nevertheless, Figure 2 shows the absence of outliers in the graph plotted using the standardized variables (right-hand side graph), whereas outliers are present in the left-hand side graph based on unstandardized variables. In other words, the use of standardized variables has helped eliminate outlier problems.

## 6. Empirical outcomes

To start with, we note that the outcomes of the tests that help examine the validity of the two-step system GMM estimator in performing the empirical analysis (see the bottom of all

columns of Tables 1 to 6) are fully satisfactory, as the null hypotheses of these tests are almost all<sup>15</sup> not rejected, and the p-values of the OID test are all higher than 0.10. Additionally, across the six Tables, the coefficient of the one-period lag of the dependent variable is positive and always significant at the 1% level. This shows the existence of an inertia in the wage inequality variable, and hence underline the use of the dynamic specification in model (1). Additionally, the number of instruments is always lower than the number of countries used in the regressions. From now onwards, and for the sake of simplicity, we will sometimes use the expression 'wage inequality' to refer to 'wage inequality in the manufacturing sector'.

Estimates in column [1] of Table 1 show that at the 5% level, total AfT flows are negatively associated with wage inequality, thereby suggesting that higher total AfT flows contribute to reducing wage inequality in the manufacturing sector. As previously discussed, this can take place through a variety of channels, including trade policy liberalization (or trade openness), manufacturing export performance, export product diversification, inward FDI, imports of manufactured products as well as the extent of multilateral trade liberalization. This negative effect of total AfT flows on wage inequality is confirmed when we consider results in column [2]. In particular, we obtain that both AfT flows for the industry sector and AfT flows allocated to the non-industry sectors exert a negative and significant effect (at the 1% level) on wage inequality. These suggest that AfT interventions contribute to the increase in the wages of unskilled (or low-skilled) workers (or to the reduction of wages across different sub-sectors) in the manufacturing sector. In terms of the magnitude of these impacts, a 1 standard deviation in total AfT flows induces a fall in wage inequality by a 0.114 standard deviation (to recall, Appendix 3a contains standard deviation of all variables used in the analysis). Likewise, a 1 standard deviation in AfT flows for the industry sector and AfT flows related to the non-industry sectors are associated with a fall in wage inequality respectively by a 0.091 standard deviation and a 0.086 standard deviation. The magnitude of the effect of these two components of total AfT flows on wage inequality are quite similar. Results in column [3] show that the coefficient of "AfTTOT" and the interaction term related to the interaction variable (between total AfT flows and the real per capita income variables) are both negative and significant (at the 1% level for the former and 5% for the latter). These two outcomes indicate that total AfT flows always exert a negative effect on wage inequality (irrespective of the level of the real per capita income), and the magnitude of this negative effect increases as the real per capita income increases. In other words, total AfT flows exert a higher reducing effect on wage inequality in advanced developing countries than in relatively less advanced countries. In the three columns of Table 1, coefficients of control variables exhibit the same sign and statistical significance, although they are sometimes different. In particular, we find that a higher education level widens the wage inequality, while an increase in the real per capita income and higher inflation rates reduce wage inequality. Among all variables in columns [1] and [2] of Table 1, the real per capita income appears to be the one that contributes the most to explaining the dynamics of wage inequality. The real per capita income variable is followed by the inflation rate, the education level, and finally the AfT flows variables. Thus, AfT flows variables appear to be the ones that contribute the least to explaining the dynamics of wage inequality in

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<sup>15</sup> The exception here concern the results of the AR(3) test displayed at the bottom of column [6] of Table. As the p-value associated with the AR(3) test amounts to 0.0866, we reject the null hypothesis related to this test at the 5% level. Thus, at the 5%, results in columns [6] of Table 4 are reliable. It is important to recall that the AR(3) test is not mandatory as it has not explicitly been recommended by the proponents of the two-step system GMM estimator.

recipient-countries. However, as the effects of AfT flows variables translate through many factors that are for the time being not incorporated in the regressions, the rank in terms of the contribution of AfT interventions to explaining the dynamics of wage inequality might change significantly, once these factors would be accounted for.

We now turn to the results reported in Table 2. In column [1] of this Table, the coefficient of both "AfTTOT" and the interaction of the latter with "DTP" are both negative and significant at the 1% level. These suggest that irrespective of the degree of trade policy liberalization, total AfT flows always reduce wage inequality, and additionally, total AfT flows exert a greater reduction effect on wage inequality as countries further liberalize their domestic trade policies. In column [2] of the same Table, the coefficient of "AfTTOT" is not significant at the conventional levels, while the interaction term associated with the interaction variable between "AfTTOT" and "OPEN" is negative and significant at the 1% level. These signify that higher total AfT flows consistently reduce wage inequality, and the magnitude of this negative effect rises as countries experience greater trade openness. It is worth noting that across these two columns of Table 2, greater trade policy liberalization and trade openness are negatively and significantly associated with wage inequality. Estimates in column [3] show negative and significant coefficients (at the 1% level) of "AfTTOT" and of the interaction between the latter and the variable "OPENSW". This confirms findings in columns [1] and [2] that the magnitude of the reducing wage inequality effect of total AfT flows increases as countries enjoy a greater trade openness, including a greater 'genuine' participation in world trade. Overall, results in Table 2 show that AfT interventions (total AfT flows) tend to favour wages of unskilled workers (or to reduce wages across different sub-sectors) in the manufacturing sector, in particular as countries experience a higher level of trade policy liberalization or greater trade openness.

Considering now the outcomes<sup>16</sup> in Table 3, we note across the four columns that the interaction terms of the interaction variable between the total AfT flows and the size of inward FDI are all negative, but significant at the 1% level (when the AfT variable is interacted with the inward FDI stock, either in real terms or in percentage of GDP) (see columns [1] and [2]) and significant at the 5% level when the AfT variable is interacted with the net FDI inflows variables, expressed either in real values or in percentage of GDP (see columns [3] and [4]). At the same time, the variable "AfTTOT" exhibits in columns [1] and [2] coefficients that are not significant at the conventional levels, while in columns [3] and [4], the coefficients are significant at least at the 5% level. On the basis of these results, we conclude that AfT interventions (through higher total AfT flows) reduce wage inequality in countries that enjoy a higher size of inward FDI, with the magnitude of this reducing effect increasing as the size of inward FDI rises. One interpretation of these results is that AfT interventions help reduce the SBTC effect of inward FDI on wage inequality, including by favouring the employment of low-skilled workers (within a subsector of the manufacturing sector or in many sub-sectors of the manufacturing sector), and hence reducing the wage gap between low-skilled workers and high-skilled workers. Estimations' outcomes displayed in column [1] of Table 4 suggest that the effect of total AfT flows on wage inequality does not depend on the share of total manufacturing exports in total export products. This is because the interaction term associated with the interaction variable between

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<sup>16</sup> It is noteworthy that we have followed Figini and Görg (2011) and introduced the squared terms of the inward FDI variable in the model specifications, but we have consistently not found a non-linear effect of FDI on the wage inequality variable.

"AfTTOT" and "MANTOTEXP" is not significant at the conventional levels, even though the coefficient of "AfTTOT" is negative and significant at the 1% level. However, this surprising outcome hides, as shown across columns [2] to [5] of Table 4, the fact that AfT interventions can exert a significant effect on wage inequality when considering different components of the total manufacturing exports (as a share of total export products). In particular, across columns [2] and [3], we find that, at least at the 5% level, total AfT flows contribute to lowering wage inequality in countries with a higher share of labour-intensive and resource-intensive manufactures exports (in total export products) or alternatively a higher share of low-skill and technology-intensive manufactures exports (in total export products). These outcomes are consistent with our theoretical expectations that AfT flows can lead to lower wage inequality if they are used to promote the export of labour-intensive (or low-skilled) manufacturing products. In addition, in column [5], we observe that at the 5% level, total AfT flows reduce wage inequality as countries experience a rise in high-skill and technology-intensive manufactures exports. This might suggest that by providing workers with jobs and income opportunities, AfT interventions contribute to reducing the wage gap between low-skilled (or unskilled) workers and high-skilled workers, when countries enjoy a rise in high-skill manufactured exports (which were supposed to drive the demand for skilled labour and increase wage inequality). This result might also reflect the fact that AfT flows help reduce the inter-'sub'sectorial wage gap within the manufacturing sector when countries experience an increase in high-skill manufactured exports. In contrast to these findings, results in column [4] suggest that at the conventional levels, medium-skill and technology-intensive manufactures exports do not matter for the effect of total AfT flows on wage inequality.

Finally, results in column [6] of Table 4 suggest that both the coefficient of "AfTTOT" and the coefficient of the interaction between total AfT flows and the export product concentration index are negative and significant at the 1% level. Incidentally, the variable "ECI" shows a positive and significant coefficient at the 1% level. Taking together, these outcomes suggest that AfT flows reduce wage inequality in countries that experience a high level of export product concentration, and the greater this level, the higher is the magnitude of the reducing effect of total AfT flows on wage inequality. One practical interpretation of this result can be that AfT interventions providing unskilled (or low-skilled) workers with the opportunities either to have access to an income generating activity, or to improve their export revenue. Therefore, the resource flows can ultimately help reduce the wage gap between high-skilled labour and low-skilled (or unskilled) labour in countries that experience a greater export product concentration (as in many developing countries, export products are usually concentrated on low-value added products, and is therefore associated with a high wage inequality between skilled and unskilled workers). We now take-up results in Table 5. We note across the three columns of this Table that the coefficients of the interaction variables ["AfTTOT\*SHMANIMP"], ["AfTTOT\*MEDHIGHIMP"], and ["AfTTOT\*MACHIMP"] are all negative and significant at the 1% level. At the same time, the "AfTTOT" variable holds a negative and significant coefficient (at the 1% level) only in column [1], as in the two other columns, the coefficient of this variable is not significant at the conventional levels. On the basis of these results, we conclude that total AfT flows exert a higher negative effect on wage inequality as countries experience a higher share of total imports of manufacturing products, a higher share of imports of manufacturing products intensive in both medium-skill and high-skill and technology, or a rise in the share of imports of machinery and transport equipment (all being expressed in percentage of total import products). Thus, AfT flows can help dampen the

widening wage inequality effect that may be associated with the import of manufacturing products (and its possible associated SBTC effect).

Finally, results in Table 6 indicate negative and significant coefficients (at the 1% level) for both "AfT<sup>TOT</sup>" and the interaction variable ["AfT<sup>TOT</sup>\*SMTP"]. Hence, higher amounts of total AfT flows influence negatively wage inequality in the context of greater multilateral trade liberalization. In particular, the magnitude of this reducing wage inequality effect of AfT flows increases as countries enjoy a greater extent of multilateral trade liberalization. On another note, the variable "MTP" holds a negative and significant coefficient (at the 1% level) thereby suggesting greater multilateral trade liberalization induces lower wage inequality (though this coefficient should be interpreted in conjunction with the interaction term of the interaction variable).

Results concerning the control variables in Tables 2 to 6 are similar to those in Table 1.

## 7. Conclusion

This study provides an empirical analysis of the effect of AfT interventions on wage inequality in the manufacturing sector of recipient-countries. The analysis has used a sample of 65 countries over the period 1996-2016, and provided interesting results. AfT flows reduce wage inequality in the manufacturing sector of recipient-countries that liberalize their trade regimes, enjoy greater trade openness, increase their manufacturing exports, including those that are labour-intensive, low-skill and high skill intensive, and import manufacturing products (for example machinery and transport equipment goods). AfT interventions also help mitigate the negative effect of export product concentration (including on primary products) on wage inequality in the manufacturing sector. Finally, AfT flows reduce wage inequality in the manufacturing sector of countries that enjoy a greater extent of multilateral trade liberalization.

Overall, this analysis has shown that AfT flows do not affect only recipient-countries' trade performance, but also the wage inequality in the manufacturing sector of these countries, through a variety of channels.

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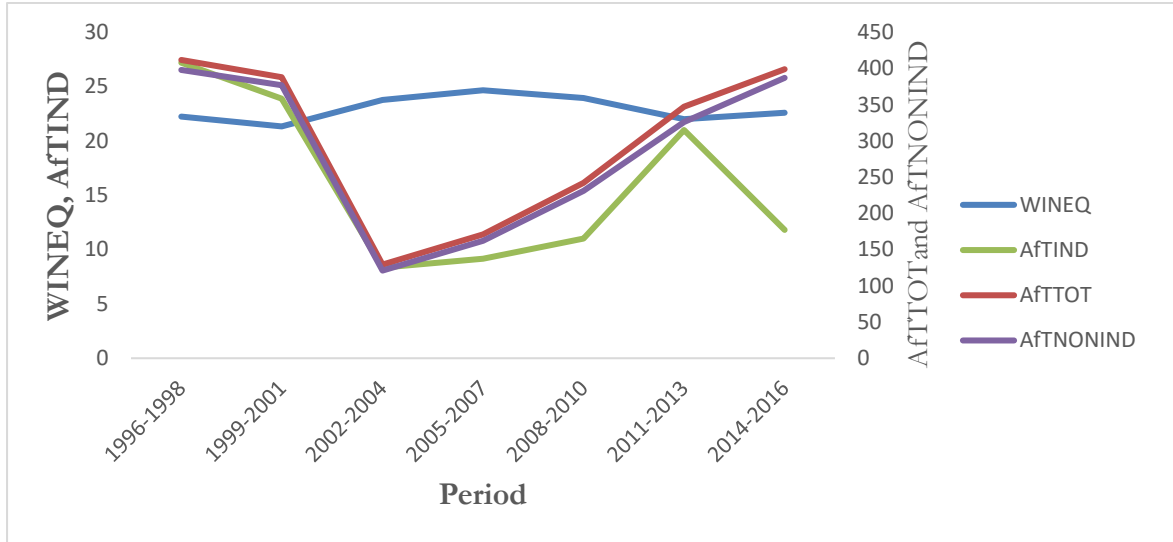
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## FIGURES

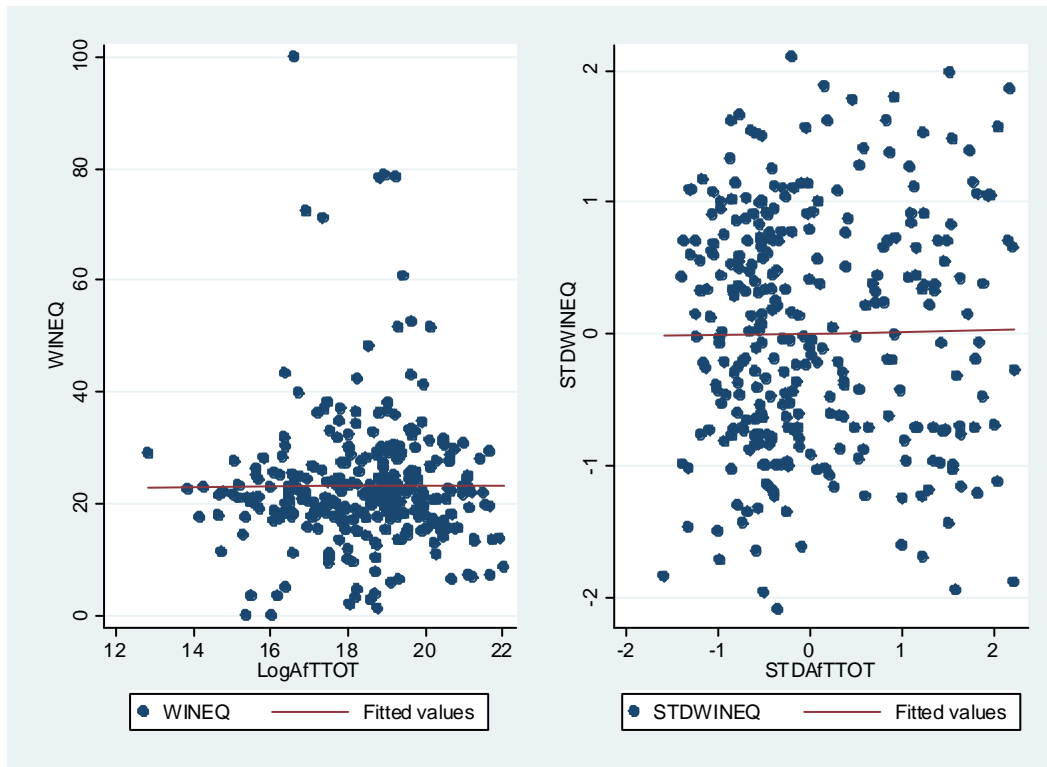
**Figure 1:** Cross-plot between AfT flows and WINEQ



Source: Author

Note: The variables "AfTTOT", "AfTIND" and "AfTNONIND" represent respectively total AfT flows, AfT flows allocated to the industry sector, and AfT flows for the non-industry sector. They are expressed in millions of US\$, Constant 2016 Prices.

**Figure 2:** Cross-plot between total AfT flows and Wage inequality in the manufacturing sector



Source: Author

## TABLES and APPENDICES

**Table 1:** Impact of AfT flows on Wage Inequality in the Manufacturing Sector  
*Estimator:* Two-step system GMM

Variables	WINEQ	WINEQ	WINEQ
	(1)	(2)	(3)
WINEQ <sub>t-1</sub>	0.380*** (0.0333)	0.388*** (0.00976)	0.392*** (0.0161)
AfTTOT	-0.114** (0.0488)		-0.125*** (0.0247)
AfTIND		-0.0907*** (0.0159)	
AfTNONIND		-0.0863*** (0.0238)	
AfTTOT*GDPC			-0.0316** (0.0136)
GDPC	-0.240*** (0.0456)	-0.223*** (0.0280)	-0.248*** (0.0290)
EDU	0.189*** (0.0475)	0.129*** (0.0145)	0.206*** (0.0210)
INFL	-0.233*** (0.0335)	-0.137*** (0.0114)	-0.212*** (0.0205)
Constant	0.00216 (0.0226)	0.00196 (0.0132)	0.0206 (0.0135)
Observations - Countries	234 - 65	234 - 65	234 - 65
Number of Instruments	48	59	62
AR1 (P-Value)	0.0011	0.0011	0.0012
AR2 (P-Value)	0.7876	0.9073	0.7957
AR3 (P-Value)	0.3065	0.1855	0.3294
Sargan (P-Value)	0.4246	0.5273	0.5842

*Note:* \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.

**Table 2:** Impact of AfT flows on Wage Inequality in the Manufacturing Sector for varying levels of trade liberalization/trade openness

*Estimator.* Two-step system GMM

Variables	WINEQ	WINEQ	WINEQ
	(1)	(2)	(3)
WINEQ <sub>t-1</sub>	0.364*** (0.0204)	0.387*** (0.00981)	0.377*** (0.0133)
AfT <sup>*</sup> TOT	-0.119*** (0.0241)	0.00315 (0.0241)	-0.129*** (0.0326)
AfT <sup>*</sup> TOT*DTP	-0.189*** (0.0248)		
AfT <sup>*</sup> TOT*OPEN		-0.193*** (0.0276)	
AfT <sup>*</sup> TOT*OPENS			-0.285*** (0.0238)
DTP	-0.112*** (0.0239)		
OPEN		-0.0350** (0.0136)	
OPENS			0.121*** (0.0206)
GDP	-0.258*** (0.0300)	-0.261*** (0.0376)	-0.393*** (0.0281)
EDU	0.260*** (0.0310)	0.103*** (0.0145)	0.250*** (0.0374)
INFL	-0.254*** (0.0200)	-0.175*** (0.0217)	-0.222*** (0.0160)
Constant	0.0412*** (0.0123)	0.0289 (0.0188)	0.0413** (0.0207)
Observations - Countries	229 - 63	231 - 64	231 - 64
Number of Instruments	60	60	60
AR1 (P-Value)	0.0005	0.0023	0.0019
AR2 (P-Value)	0.5771	0.5601	0.7165
AR3 (P-Value)	0.5533	0.6117	0.6199
Sargan (P-Value)	0.6012	0.5290	0.4881

Note: \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.

**Table 3:** Impact of AfT flows on Wage Inequality in the Manufacturing Sector for varying sizes of inward FDI

*Estimator:* Two-step system GMM

Variables	WINEQ	WINEQ	WINEQ	WINEQ
	(1)	(2)	(3)	(4)
WINEQ <sub>t-1</sub>	0.406*** (0.0220)	0.421*** (0.0191)	0.394*** (0.0124)	0.399*** (0.0102)
AfT <sup>TOT</sup>	-0.00599 (0.0242)	0.0274 (0.0429)	-0.0748** (0.0365)	-0.135*** (0.0327)
AfT <sup>TOT</sup> *FDISTOCKCST	-0.135*** (0.0284)			
AfT <sup>TOT</sup> *FDISTOCKGDP		-0.0760*** (0.0182)		
AfT <sup>TOT</sup> *FDIFLOWSCST			-0.0841** (0.0358)	
AfT <sup>TOT</sup> *FDIFLOWSGDP				-0.124** (0.0584)
FDISTOCKCST	-0.0901* (0.0490)			
FDISTOCKGDP		2.92e-05 (0.0309)		
FDIFLOWSCST			0.117*** (0.0264)	
FDIFLOWSGDP				0.00237 (0.0446)
GDP	-0.131*** (0.0321)	-0.206*** (0.0192)	-0.358*** (0.0240)	-0.239*** (0.0310)
EDU	0.157*** (0.0201)	0.0190 (0.0512)	0.248*** (0.0330)	0.182*** (0.0292)
INFL	-0.245*** (0.0236)	-0.196*** (0.0183)	-0.209*** (0.0284)	-0.205*** (0.0213)
Constant	0.0106 (0.0199)	0.0149 (0.0193)	0.00239 (0.0134)	0.00955 (0.0135)
Observations - Countries	234 - 65	234 - 65	234 - 65	234 - 65
Number of Instruments	57	60	57	57
AR1 (P-Value)	0.0010	0.0007	0.0007	0.0007
AR2 (P-Value)	0.8394	0.9678	0.7793	0.7215
AR3 (P-Value)	0.2980	0.2277	0.3265	0.4627
Sargan (P-Value)	0.3008	0.4732	0.4787	0.3930

Note: \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.

**Table 4:** Impact of AfF flows on Wage Inequality in the Manufacturing Sector for varying levels of manufactured export performance/export product diversification

*Estimator:* Two-step system GMM

Variables	WINEQ	WINEQ	WINEQ	WINEQ	WINEQ	WINEQ
	(1)	(2)	(3)	(4)	(5)	(6)
WINEQ <sub>t-1</sub>	0.395*** (0.0153)	0.426*** (0.0230)	0.367*** (0.0355)	0.412*** (0.0171)	0.394*** (0.0146)	0.374*** (0.0181)
AfF <sup>TOT</sup>	-0.107*** (0.0167)	-0.0397 (0.0439)	-0.136*** (0.0288)	-0.00490 (0.0258)	-0.0820*** (0.0268)	-0.0860*** (0.0293)
AfF <sup>TOT</sup> *MANEXP	-0.00127 (0.00962)					
AfF <sup>TOT</sup> *LABEXP		-0.159*** (0.0280)				
AfF <sup>TOT</sup> *LOWEXP			-0.143** (0.0652)			
AfF <sup>TOT</sup> *MEDEXP				-0.00745 (0.0353)		
AfF <sup>TOT</sup> *HIGHEXP					-0.0965** (0.0387)	
AfF <sup>TOT</sup> *ECI						-0.124*** (0.0339)
MANEXP	0.131*** (0.0282)					
LABEXP		0.0174 (0.0312)				
LOWEXP			-0.0522 (0.0380)			
MEDEXP				-0.228*** (0.0332)		
HIGHEXP					0.151*** (0.0418)	

ECI						0.251***
						(0.0257)
GDPC	-0.159***	-0.270***	-0.207***	-0.207***	-0.225***	-0.305***
	(0.0119)	(0.0199)	(0.0186)	(0.0377)	(0.0264)	(0.0353)
EDU	0.141***	0.138***	0.129***	0.127***	0.0750	0.140***
	(0.0291)	(0.0456)	(0.0419)	(0.0343)	(0.0508)	(0.0171)
INFL	-0.194***	-0.152***	-0.174***	-0.209***	-0.193***	-0.131***
	(0.0167)	(0.0144)	(0.0230)	(0.0230)	(0.0173)	(0.0223)
Constant	-0.0113	-0.0160	-0.0343*	0.0180	0.0224	-0.0144
	(0.0132)	(0.0208)	(0.0185)	(0.0190)	(0.0184)	(0.0144)
Observations - Countries	234 - 65	234 - 65	234 - 65	234 - 65	234 - 65	234 - 65
Number of Instruments	60	57	57	57	57	57
AR1 (P-Value)	0.0008	0.0011	0.0007	0.0011	0.0004	0.0020
AR2 (P-Value)	0.9329	0.6967	0.6912	0.9358	0.8291	0.7805
AR3 (P-Value)	0.3266	0.2573	0.4502	0.2971	0.2415	0.0866
Sargan (P-Value)	0.6108	0.4631	0.4207	0.6616	0.3839	0.5321

Note: \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.

**Table 5:** Impact of AfT on Wage Inequality in the Manufacturing Sector for varying shares of manufactured import (in total import products)

*Estimator.* Two-step system GMM

Variables	WINEQ	WINEQ	WINEQ
	(1)	(2)	(3)
WINEQ <sub>t-1</sub>	0.382***	0.367***	0.348***
	(0.0266)	(0.0234)	(0.0220)
AfT <sup>*</sup> TOT	-0.0806**	-0.0293	-0.0396
	(0.0321)	(0.0187)	(0.0289)
AfT <sup>*</sup> TOT*MANIMP	-0.234***		
	(0.0325)		
AfT <sup>*</sup> TOT*MEDHIGHIMP		-0.216***	
		(0.0398)	
AfT <sup>*</sup> TOT*MACHIMP			-0.161***
			(0.0545)
MANIMP	-0.126***		
	(0.0266)		
MEDHIGHIMP		-0.0330	
		(0.0210)	
MACHIMP			0.104**
			(0.0477)
GDPG	-0.306***	-0.315***	-0.297***
	(0.0246)	(0.0263)	(0.0266)
EDU	0.204***	0.199***	0.227***
	(0.0369)	(0.0441)	(0.0292)
INFL	-0.224***	-0.210***	-0.198***
	(0.0177)	(0.0123)	(0.0209)
Constant	-0.00649	0.0258	0.0292*
	(0.0193)	(0.0182)	(0.0164)
Observations - Countries	234 - 65	234 - 65	234 - 65
Number of Instruments	57	57	57
AR1 (P-Value)	0.0006	0.0006	0.0010
AR2 (P-Value)	0.8995	0.7607	0.7318
AR3 (P-Value)	0.2268	0.3089	0.3753
Sargan (P-Value)	0.3801	0.2762	0.3742

Note: \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.

**Table 6:** Effect of AfT flows on Wage Inequality in the Manufacturing Sector for varying degrees of multilateral trade liberalization

*Estimator.* Two-step system GMM

Variables	WINEQ
	(1)
WINEQ <sub>t-1</sub>	0.385*** (0.0147)
AfT*TOT	-0.113*** (0.0254)
AfT*TOT*MTP	-0.0623** (0.0257)
MTP	-0.280*** (0.0394)
GDPC	-0.0945* (0.0547)
EDU	0.331*** (0.0237)
INFL	-0.182*** (0.0185)
Constant	0.0516*** (0.0104)
Observations - Countries	234 - 65
Number of Instruments	60
AR1 (P-Value)	0.0014
AR2 (P-Value)	0.6720
AR3 (P-Value)	0.3107
Sargan (P-Value)	0.7683

Note: \*p-value<0.1; \*\*p-value<0.05; \*\*\*p-value<0.01. Robust Standard Errors are in parenthesis.



### Appendix 1: Definition and Source of variables

Variables	Definition	Sources
WINEQ	This is the Theil index of inequality in wages in the manufacturing sector. Its values range from 0 to 100, with higher values indicating a rising of the wage inequality.	The database includes information on total wages, employment, capital, value added, and production disaggregated at the 3-digit level of the International Standard Industrial Classification (ISIC) revision 3. Data used for the computation of the wage inequality index includes wages and salaries in the manufacturing industries classified into categories based on R&D intensities. The data is sourced from the industrial statistics database of the United Nations Industrial Development Organization (UNIDO).
AfTTOT	This is the real Gross disbursements of total Aid for Trade (expressed in constant prices 2016, US Dollar).	Author's calculation based on data extracted from the database of the OECD/DAC-CRS (Organization for Economic Cooperation and Development/Donor Assistance Committee)-Credit Reporting System (CRS). Aid for Trade data cover the following three main categories (the CRS Codes are in brackets): <u>Aid for Trade for Economic Infrastructure</u> , which includes: transport and storage (210), communications (220), and energy generation and supply (230); <u>Aid for Trade for Building Productive Capacity</u> , which includes banking and financial services (240), business and other services (250), agriculture (311), forestry (312), fishing (313), industry (321), mineral resources and mining (322), and tourism (332); and <u>Aid for Trade policy and regulations</u> , which includes trade policy and regulations and trade-related adjustment (331).
AfTIND	This is the real Gross disbursements of Aid for Trade allocated to the industry sector (expressed in constant prices 2016, US Dollar).	This variable is one component of the total AfT, and represents the part of AfT covering industry sector (321). See OECD/DAC-CRS Database.
AfTNONIND	This is the real Gross disbursements of Aid for Trade allocated to all other sectors than the industry sector (expressed in constant prices 2016, US Dollar).	Author's calculation based on data from the OECD/DAC-CRS Database.
GDPC	GDP per capita (constant 2010 US\$)	World Development Indicators of the World Bank (WDI).
DTP	This is the measure of the domestic trade policy. It is the score of “trade freedom” index. The latter is an important	Heritage Foundation (see Miller et al., 2019)

	component of the Economic Freedom Index. It is composite measure of the absence of tariff and nontariff barriers that affect imports and exports of goods and services. Higher values of TP reflect lower trade barriers, that is, higher trade liberalisation. Lower values of TP indicate rising trade restrictive measures.	
MTP	Average trade policy of the rest of the world. For a given country, this variable has been calculated as the average trade freedom score of the rest of the world.	Author's calculation based on the "DTP" variable, extracted from the Heritage Foundation.
OPEN	This is a second measure of trade openness, calculated as the sum of exports and imports of goods and services, as a share of GDP (expressed in percentage).	WDI
OPENSW	This is the measure of trade openness suggested by Squalli and Wilson (2011). It is calculated as the measure of trade openness (the variable "OPEN" previously described) adjusted by the proportion of a country's trade level relative to the average world trade (see Squalli and Wilson, 2011: p1758).	Authors' calculation based on data extracted from the WDI
ECI	This is the Export Product Concentration Index. It is calculated using the Herfindahl-Hirschmann Index. Its values are normalized so that they range between 0 and 1. An index value closer to 1 indicates a country's imports are highly concentrated on a few products. On the contrary, values closer to 0 reflect exports are more homogeneously distributed among a series of products.	UNCTAD Database.
EDU	This is the measure of the education level. It is calculated as the average of the gross primary school enrolment rate (in percentage), secondary school enrolment rate (in percentage) and tertiary school enrolment rate (in percentage).	Author's calculation based on data collected from the WDI.
MANEXP	This is the share (%) of total exports of manufactured products in total export products.	Author's calculation based on data extracted from the United Nations Conference on Trade and Development (UNCTAD) Database. See online:
LABEXP	This is the share (%) of exports of Labour-intensive and resource-intensive manufactures in total export products.	<a href="http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120">http://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120</a>

LOWEXP	This is the share (%) of exports of Low-skill and technology-intensive manufactures in total export products.	
MEDEXP	This is the share (%) of exports of Medium-skill and technology-intensive manufactures in total export products.	
HIGHEXP	This is the share (%) of the value of exports of High-skill and technology-intensive manufactures in total export products.	
MANIMP	Share (%) of total manufacturing imports in total import products.	
MEDHIGHIMP	Share (%) of Medium-skill/and High-skill and technology-intensive manufactures imports in total import products.	
MACHIMP	Share (%) of Machinery and transport equipment imports in total import products.	
ECI	This is the Export Product Concentration Index. It is calculated using the Herfindahl-Hirschmann Index. Its values are normalized so that they range between 0 and 1. An index value closer to 1 indicates a country's exports are highly concentrated on a few products. On the contrary, values closer to 0 reflect exports are more homogeneously distributed among a series of products.	UNCTAD Database.
FDISTOCKGDP	This is the measure of the share of inward Foreign Direct Investment stock, in percentage of GDP.	
FDISTOCKCST	This variable represents the transformation of the variable capturing the inward Foreign Direct Investment stock (constant US\$ 2010 prices). The variable capturing the inward FDI stock (constant US\$ 2010 prices) has been calculated by multiplying the FDI stock (% of GDP) by the real GDP (constant 2010 US\$) (e.g., Nagel et al., 2015 and Herzer, 2011).	Authors' calculation based on data on Foreign Direct Investment stock (% of GDP) from the UCNTAD database, and real GDP extracted from the WDI.
FDIFLOWSGDP	This is the measure of the net Foreign Direct Investment inflows, in percentage of GDP.	WDI

FDIFLOWSCST	<p>The variable "FDIFLOWS" is the transformation of the variable capturing inflows of Foreign Direct Investment (constant US\$ 2010 prices). The variable capturing the Foreign Direct Investment inflows (constant US\$ 2010 prices) has been calculated by multiplying the Foreign Direct Investment inflows (% of GDP) by the real GDP (constant 2010 US\$) (e.g., Nagel et al., 2015 and Herzer, 2011).</p>	<p>Authors' calculation based on data on net Foreign Direct Investment inflows (% of GDP) from the UCNTAD database, and real GDP extracted from the WDI.</p>
INST	<p>This is the variable representing the institutional and governance quality in a given country. It has been computed by extracting the first principal component (based on factor analysis) of the following six indicators of governance. These indicators include a measure of political stability and absence of violence/terrorism; the regulatory quality; an index of rule of law index; the government effectiveness index; the index of Voice and Accountability; and the index of corruption. Higher values of this index are associated with better governance and institutional quality, while lower values reflect worse governance and institutional quality.</p>	<p>Data on the components of the variable "INST" has been collected from World Bank Governance Indicators (WGI) developed by Kaufmann, Kraay and Mastruzzi (2010) and recently updated.</p>
INFL	<p>This is the annual inflation rate (%) is based on Consumer Price Index -CPI- (annual %) where missing values has been replaced with values of the GDP Deflator (annual %).</p>	<p>Authors' calculation based on data from the WDI.</p>

## Appendix 2: Description of the method used to expand AfT data

We rely on AfT commitment data and adopt the approach used in Clemens et al. (2012), Thiele et al. (2006) and Selaya and Sunesen (2012) to expand AfT data to the period 1996-2016. The approach assumes that the proportion of AfT actually disbursed to sector "x" ( $AfT_x$ ) (for example, AfT disbursed for economic infrastructure; productive capacity building; and trade policies and regulations) during a given period is equal to the proportion of aid committed to sector x during this period, and is hence given by  $AfT_x = \frac{Commit_x}{\sum_x Commit_x} \sum_x AfT_x$ , where  $Commit_x$  stands for the amount of real AfT commitments (constant US dollar 2016 prices) to sector x;  $\sum_x AfT_x$  is the total amounts of AfT commitments and disbursements (constant US dollar 2016 prices) received during each period respectively. While there may be some concerns about the approximation of sectoral disbursements with sectoral commitments because of differences in definitions and statistical record (see Clemens et al. 2012 for more details), Odedokun (2003) and Clemens et al. (2012) have noted that this problem is likely to be small since aid disbursements and commitments (both on the aggregate and sectoral levels) are highly correlated. Using this formula and based on AfT commitments and disbursements (constant US dollar 2016 prices) extracting from the OECD/CRS database, we have calculated for each country-year, from 1996 to 2001, data on gross disbursements of AfT (including for all components of total AfT flows considered in the analysis). This dataset has been merged with the available dataset on OECD/CRS database over the period 2002-2016 (of the OECD/CRS database), and we finally get our dataset of 65 countries over the period 1996-2016.

## Appendix 3a: Standard descriptive statistics on the unstandardized variables used in the analysis

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
WINEQ	325	22.92922	11.57086	.001837	100
AfTTOT	427	2.98e+08	4.96e+08	375209.3	3.65e+09
AfTIND	423	1.60e+07	3.41e+07	1640	3.49e+08
AfTNONIND	423	2.84e+08	4.74e+08	206329.4	3.51e+09
EDU	445	71.653	18.794	4.669	111.962
GDP	453	4966.359	5120.720	222.965	25027.410
INFL	452	8.494	12.074	-2.724	174.478
DTP	432	68.057	12.386	13.467	88.533
OPEN	434	81.177	42.511	0.175	317.364
OPENS	434	0.003	0.006	0.000	0.044
FDISTOCKCST	449	4.60e+12	1.03e+13	1.38e+09	9.88e+13
FDISTOCKGDP	451	42.524	137.647	0.380	1708.986
FDIFLOWSCST	450	6.48e+11	2.17e+12	-8.95e+11	2.30e+13
FDIFLOWSGDP	450	5.213	19.383	-11.196	387.716
MANEXP	451	42.211	28.325	0.888	93.878
LABEXP	451	15.784	17.655	0.072	86.920
LOWEXP	451	5.163	6.512	0.026	43.244
MEDEXP	451	8.414	9.147	0.038	45.388
HIGHEXP	451	12.850	13.881	0.406	68.966
ECI	451	0.300	0.181	0.071	0.874
MANIMP	451	64.564	10.442	36.847	87.850
MEDHIGHIMP	451	44.845	10.895	23.344	73.511
MACHIMP	451	30.151	9.494	11.857	61.753
MTP	455	68.134	6.135	58.487	75.434

**Appendix 3b:** Standard descriptive statistics on the standardized variables used in the analysis

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
WINEQ	325	5.88e-07	0.896	-2.129	2.102
AfITOT	427	7.42e-09	0.922	-1.604	2.226
AfTIND	423	4.62e-09	0.921	-1.828	2.258
AfTNONIND	423	4.55e-09	0.921	-1.569	2.233
EDU	445	3.79e-08	0.925	-2.203	1.974
GDPG	453	1.26e-08	0.927	-2.097	1.943
INFL	452	-1.77e-09	0.926	-2.177	2.255
DTP	432	-1.86e-08	0.924	-2.040	1.810
OPEN	434	1.97e-08	0.924	-2.052	1.996
OPENS	434	2.66e-08	0.924	-1.975	1.996
FDISTOCKCST	449	1.17e-08	0.926	-2.001	2.136
FDISTOCKGDP	451	2.77e-09	0.926	-2.118	2.104
FDIFLOWCST	450	6.17e-09	0.926	-2.008	2.206
FDIFLOWGDP	450	-8.40e-09	0.926	-2.022	2.214
MANEXP	451	-6.60e-08	0.926	-2.053	2.204
LABEXP	451	8.06e-09	0.926	-2.001	2.248
LOWEXP	451	-1.55e-08	0.926	-1.886	2.128
MEDEXP	451	2.93e-08	0.926	-2.253	2.216
HIGHEXP	451	-3.93e-08	0.926	-2.061	2.135
ECI	451	1.98e-08	0.926	-2.124	2.197
MANIMP	451	-7.11e-10	0.926	-2.061	2.181
MEDHIGHIMP	451	-7.97e-09	0.926	-1.988	2.180
MACHIMP	451	6.43e-09	0.926	-1.995	2.090
MTP	455	-2.13e-08	0.927	-1.448	1.083

**Appendix 4:** List of countries used in the Full Sample

Full sample				
Afghanistan	Colombia	Korea, Rep.	Montenegro	Serbia
Albania	Costa Rica	Kyrgyz Republic	Morocco	Slovenia
Algeria	Croatia	Lesotho	Mozambique	South Africa
Argentina	Ecuador	Macedonia, FYR	Myanmar	Sri Lanka
Armenia	Egypt, Arab Rep.	Madagascar	Nepal	Tanzania
Azerbaijan	Fiji	Malawi	Niger	Thailand
Belarus	India	Malaysia	Oman	Trinidad and Tobago
Bolivia	Indonesia	Maldives	Pakistan	Tunisia
Botswana	Iran, Islamic Rep.	Malta	Panama	Turkey
Brazil	Jamaica	Mauritius	Papua New Guinea	Uganda
Burundi	Jordan	Mexico	Paraguay	Ukraine
Chile	Kazakhstan	Moldova	Philippines	Vietnam
China	Kenya	Mongolia	Senegal	Yemen, Rep.