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LOCAL CONTENT REQUIREMENTS AND THEIR ECONOMIC EFFECT ON SHIPBUILDING

A QUANTITATIVE ASSESSMENT

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LOCAL CONTENT REQUIREMENTS AND THEIR ECONOMIC EFFECT ON SHIPBUILDING – A QUANTITATIVE ASSESSMENT

Karin Gourdon and Joaquim J. M. Guilhoto

This study quantifies the significant economic gains that are expected to be revealed through the abolition or relaxation of local content based policies. The work analyses two specific local content policies affecting directly or indirectly the shipbuilding industry in two countries: Brazil's local content requirement as part of national concession contracts in the oil and gas sector, and the long-standing US Jones Act obliging intra-US seaborne trade to be conducted on US built and US flagged vessels. The paper's static simulation exploits OECD's latest Trade-in-Value-Added (TiVA) data – a rich database on Inter-Country Input-Output relationships. The database has been disaggregated to the level of the shipbuilding industry, enabling an assessment of the effect of the two selected policies on inter-industry trade. The simulation results suggest large economic benefits for both countries in the long-term despite initial losses in the target industry.

The study was authored by Karin Gourdon from the Structural Policy Division (SPD) at the OECD Directorate for Science, Technology and Innovation (STI). The simulation was conducted by Joaquim J. M. Guilhoto (OECD/STI). Ali Alsamawi, Joaquim J. M. Guilhoto and Norihiko Yamano (OECD/STI) created the database at a very detailed industry-level, which was essential for a simulation at the level of the shipbuilding industry. Laurent Daniel (OECD/STI) and Nick Johnstone (OECD/STI) contributed with essential insights and suggestions, and supervised the project. The paper has also benefitted from helpful suggestions and feedback from Sarah Box and Dirk Pilat (OECD/STI). Christian Steidl (OECD/STI) provided research support at the initial stages of the project.

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Executive Summary

Local content requirements (LCRs) are prominent government policy instruments in both developed and developing countries. While LCRs may help governments to achieve certain short-term goals, such as to meet employment, industrial or technological development objectives, in the long-term they can be counter-productive insofar as they have been shown to generate indirect costs in the economy.

Amongst others, the shipbuilding industry is currently confronted with two major policies with significant elements of local content requirements in Brazil and the United States (US). While there have been some recent reforms to Brazil's local content regulation in its oil and gas sector, there are no reforms expected to the long-standing US Jones Act.

Empirical results about the effect of LCRs on the shipbuilding sector are rather scarce. As such the estimates of the economic impact for these two examples are particularly valuable. The rich infrastructure of OECD's Inter-Country Input-Output data used for this study allows a simulation based on a static model of the Brazilian and US policies' effects on their domestic shipbuilding industries, and on other sectors in their economies. The simulation results suggest large benefits following the proposed relaxation and hypothetical abolition of the LCRs in the two countries despite initial losses in the target industry.

Brazil stands to reap significant economic gains from reforms

With the recent amendments in Brazil's local content regulation in its oil and gas sector, the country has the opportunity to generate in the long-term large economic gains which may more than offset the estimated short-term losses of around USD 2.4 billion (-0.1%) in total output. These gains can materialise through three channels.

First, the opportunity to source from foreign markets may lead to reduced prices, increased productivity and a rise in new demand. In particular, in the oil and gas sector an increase in final demand of USD 1 billion (in total output of USD 1.03 billion representing 2.2% of total output in the oil and gas sector) would stimulate Brazil's total economic output by an additional USD 1.8 billion (+0.06%) resulting in an increase in value added of USD 0.5 billion in the sector itself, and of USD 0.9 billion for the total economy. To put these numbers into perspective: an increase of only 0.03% in the oil production volume in 2017 at a conventional price of USD 60 per barrel would already offset the short-term losses. The National Agency of Petroleum, Natural Gas and Biofuels (ANP) expects an increase in oil production of, on average, 40% compared to the levels of 2017.

Second, the policy reform is estimated to lead to an additional USD 28 billion in royalties collected by the government until 2027 (USD 2.8 billion per year). Hence, increased government income could propagate throughout the economy in the form of increased government expenditures (if not used to repay debt). The results show that an increase of USD 1 billion in government spending would trigger off an increase in Brazil's total output of USD 1.4 billion and an increase in Brazil's value added of USD 0.9 billion. In other words, government spending of USD 1.7 billion (60% of collected annual royalties) could already compensate for the short-term losses. Against the background of Brazil's high government spending relative to its income (-6% in fiscal balance in 2014) the royalties would be beneficial to the government either in the form of investments or debt repayments.

Third, the ANP expects a total of 95 000 new shipyard positions as a result of the amended local content policy. Assuming newly created worker positions in the shipbuilding industry

as a result of the LCR reform rather than labour flows from other sectors of the economy, the increase in disposable income would fuel private consumption and thereby increase Brazil's total output and value added in the long-run. The results imply that with an increase of USD 1 billion in household expenditures, Brazil's total output would increase by USD 1.6 billion (+0.001%) and its value added by USD 0.9 billion (+0.0003%). With the newly created jobs, Brazil could expect an increase in household consumption of around USD 1.76 billion, thereby outweighing the short-term losses through this third channel.

Overall, the simulations suggest that Brazil is heading in the right direction by opening up its national oil and gas sector to foreign players. Despite certain short-term losses, the long-term benefits are evident for the total economy in general and for different sectors in particular. Among others, the oil and gas sector along with the shipbuilding industry would have the opportunity to benefit from a more outward-focused economic environment, which has been shown to stimulate industrial development and economic growth.

The US shipbuilding industry holds unrealised potential

The simulations suggest that a hypothetical repeal of the Jones Act, thereby opening up the US shipbuilding industry, would require shipbuilders to reduce vessel prices by at least 50% to converge to international levels in order to remain competitive. This adjustment process can either be stimulated through productivity gains and/or cost reductions as a result of shifts in sourcing patterns away from domestic to foreign markets. In turn, a decline in ship prices would not only stimulate new demand for US vessels, but would also result in the long-term in cheaper transportation services for intra-US trade. The estimation results reveal large benefits for the US economy in total, the shipbuilding industry in particular, as well as other US industries. The US commercial shipbuilding industry has the potential to increase its final demand by around 70%, from around USD 841 million to USD 1.43 billion. Despite the repeal of the Jones Act, the model's static results suggest that the domestic US commercial shipbuilding industry would benefit from an increase in value added of around USD 44 million (+10% from previous USD 412 million).

Beyond the shipbuilding sector itself, the beneficial effects on the US economy are largely a result of the increase in industrial activity in other US sectors benefitting from reduced water transportation costs for intra-US trade. Depending on the scenario assumed, these US industries could generate at least additional final demand of around USD 22 billion (+0.11%), and further output of approximately USD 40 billion (+0.13%), which represent respectively more than 37 and 65 times the original US commercial shipbuilding industry prior to the Act's removal. The removal may furthermore generate additional domestic value added in other US industries. Those can expect an increase of about USD 19 billion (+0.11%), equivalent to 439 times the volume generated in the commercial US shipbuilding industry under the Jones Act. The dimensions are extreme, simply by virtue of comparing US industries of immense size that produce goods and services for the domestic market with the usage of water transport services, with the US commercial shipbuilding industry which represents only a small fraction of the US economy.

From an economic perspective, the Act evidently creates large cost inefficiencies by protecting the shipbuilding industry – a tiny economic sector in the US – at the expense of other US industries with enormous economic potential. The conclusions also hold under several sensitivity analyses. The study's results are a "mirror image" of previous outcomes on the estimation of economic costs as a consequence of the Act. With the abolishment of the Act the associated gains could in the long-term more than compensate the initial losses incurred by the US shipbuilding industry.

1. Introduction

Localisation based policies have a long history in the toolkit of governments in both developed and developing countries. Policy makers usually draw on various forms of local content policies with the belief that such measures will generate economic and social benefits to the domestic economy. The most widely promoted policy objectives attached to such government measures are threefold: generating domestic employment, enhancing competitiveness of the target industry in the global market, and supporting local ownership requirements for strategic industries (Deringer et al., 2018[1]).[1]

Despite their well-documented counter-productive outcomes their popularity has increased in the aftermath of the 2008 economic recession.[2] It is often argued that this form of non-tariff measure is still prevalent since it is less easily recognised as a protectionist tool (Belderbos and Sleuwaegen, 1997[2]). As they are based on quantity signals in the form of complex percentage input requirements, the price effects are difficult to determine, making it a rather opaque measure. Policymakers (and others) can only assess the real economic costs of such policies with some difficulty, or may not know the counterfactual outcomes (i.e. without the policy) in which the market might have achieved the policy goals by its own (Hufbauer et al., 2013[3]). This opacity may be intentional or incidental.

This study contributes to the ongoing efforts of analysing and quantifying various government programs present in the shipbuilding industry. While Gourdon (2019[4]) discusses a wide-range of different classes of government measures and their effect on the shipbuilding sector, the following work focuses on local content requirements (LCRs).

One important aspect of these policies is the requirement for firms to procure a minimum percentage of value added or intermediate inputs domestically. The scope of the requirement and/or the necessity for compliance can thereby vary. For instance, there are differences in the policy coverage, ranging from goods, services, data storage, to staff or subcontractor requirements. Some policies also oblige or encourage firms to provide additional economic benefits to the local economy, such as in the form of in-country investments, transfer of technology or knowledge, production under license, or marketing/exporting assistance (Gourdon, Bastien and Folliot-Lalliot, 2017[5]).[3] Regarding the necessity for compliance, one can distinguish between: (i) whether compliance with the requirement is mandatory in order to access the market or to receive other benefits in the form of tax, tariffs and price concessions; or, (ii) whether non-compliance entails the payment of a penalty tariff rate on intermediate inputs (Grossman, 1981[5]; Hufbauer et al., 2013[3]). LCRs are often part of government procurement measures.[4]

Some scholars argue that although the effects of LCRs can hardly be measured and their impact depend on the market condition and industry structure, LCRs can contribute to industrial development and competitiveness if well designed and linked to other policies (Weiss, 2016[6]). A country's level of development, resource endowments and sector maturity are critical factors to be considered prior to policy implementation (Ramdoo, 2016[7]). R&D capabilities, skills and domestic entrepreneurship are further elements affecting the effectiveness of such government measures.

Yet, most studies on LCRs highlight the long-run inefficiencies that arise in the economy as a result of the policy. By implementing an LCR the target industry is required to source (a part of) its inputs domestically. Absent the policy, companies are able to freely decide to purchase from domestic or foreign suppliers under profit maximization considerations.

Hence, their observed intermediate input use and sourcing pattern are based on optimal allocation at given prices.

However, with the LCR policy in place, firms are obliged to purchase less competitive and more expensive intermediate inputs domestically than they could acquire on the international market.[5] The policy results in the intended increase in output of the local upstream sector, increasing welfare, but only in the short-term. In the long-term, the higher prices of domestically procured components will increase the price of the final good and, as a result, the quantity sold will decline as will domestic welfare.[6]

Previous work of the OECD's Trade and Agriculture Directorate highlights the costs associated with LCRs imposed not only on the target sector, but also on other sectors in the economy from a trade perspective (Stone, Messent and Flaig, 2015[8]). The study differentiates between the impact on intermediate inputs and final demand, and examines the decline in trade with third countries. The analysis shows that although final goods are affected by the LCR, around 80% of the decline in trade arises from the policy's effects on intermediate products. Households and other non-LCR targeted sectors are only able to mitigate the losses inflicted by the policy by shifting from local to international markets – a development such a protectionist measure initially tried to hamper (Stone, Messent and Flaig, 2015[8]). The results illustrate the policies' overall negative impact on trade by restricting imports and reducing exports. Furthermore, LCRs increase the price for imported goods, leading to higher prices for firms and consumers. In the short term, the industry output in the target sector may increase but only at the expense of other related industries, outweighing the benefits by negative side effects.

More recently, Dixon, Rimmer and Waschik (2018[9]) found that the "US Buy American Act" offers domestic manufacturing industries only a small level of protection against import competition and results in other sectors of the economy having around 360 000 fewer jobs than would have been the case if the Act were to be abolished.[7] Using a model of successive oligopoly in up- and downstream industries, Belderbos and Sleuwaegen (1997[2]) find that LCRs have anti-competitive effects and generally fail to increase domestic welfare. Although Veloso (2006[10]) argues that under the assumption of positive spill-over effects moderate LCRs might be welfare-enhancing, he concedes that too high LCRs can have significant detrimental effects on the economy. Which effect dominates depends not only on the price elasticity of demand for the final goods, but also on the price elasticity of intermediate goods used in its production and their degree of tradability.

Further studies argue that LCRs can result in an inefficient allocation of resources by distorting the principle of comparative advantage, a reduction in competition for the target industry, a decline in product quality by inhibiting access to technologically-advanced inputs, as well as corruption and favouritism if the policy design is opaque (Hufbauer et al., 2013[3]; Kuntze and Moerenhout, 2013[11]; Weiss, 2016[6]). Hufbauer et al. (2013[3]) argue that the objectives of LCRs, such as building up a competitive industry through stronger industrial links, supplier's creation and backward linkage can hardly be obtained. In most cases, LCRs isolate high-cost producers from global competition and innovation, and result in insufficient incentives for R&D investments. In general, it was observed that stronger domestic linkages are created when foreign firms find competitive partners in the domestic economy.

Sectoral studies on the costs and benefits associated with LCRs have been undertaken, among others, on the oil and gas industry (Hufbauer et al., 2013[3]; Tordo et al., 2013[12]; Heum et al., 2011[13]), automobile (Hufbauer et al., 2013[3]; Veloso, 2006[10]), renewable energy (Hufbauer et al. (2013[3]) on photovoltaic and wind; Kuntze and Moerenhout,

2013[11]; Bahar, Egeland and Steenblik, 2013[14]), heavy vehicle (Deringer et al., 2018[1]) and health care (Hufbauer et al., 2013[3]) sectors. These have generally concluded that while these policies may achieve certain short-run objectives (such as to meet employment, industrial or technological development goals), they undermine industrial competitiveness over the long-run and for the economy as a whole.

Empirical results about the effect of LCRs on the shipbuilding sector are rather scarce although LCR policies are relatively common in the sector. The most closely related analysis to our work comes from Francois et al. (1996[11]) albeit it focusses on the water transportation sector rather than shipbuilding specifically. The authors simulate the effects of a reduction in water transportation costs on welfare, production, trade, and employment in the US economy and a selection of important up- and downstream industries, including shipbuilding, as a consequence of a removal of the US Jones Act. In order to fill the gap in the literature, the following work represents to our knowledge the first study on the quantification of the impact of LCRs specifically affecting the shipbuilding sector with the use of Inter-Country Input-Output (ICIO) data. The rich data structure allows an assessment of the policy's effects in terms of final demand, total output and value added on the domestic shipbuilding industry as well as on other sectors in the economy. Gourdon and Steidl (forthcoming[12]) provide more information about OECD's ICIO data, so-called Trade-in-Value-Added (TiVA), applied to the shipbuilding industry in the context of an analysis of global value chains.

The analysis encompasses simulations for the reduction in Brazil's local content requirement present in its national oil and gas sector, and a hypothetical abolishment of the long-standing US Jones Act. The results show the significant economic gains a relaxation and an abolition of local content policies can have on the imposing country's own economy.

The paper is structured as follows. Section 1 provides a description of LCRs affecting the shipbuilding industry. Section 2 presents the static model's results of the simulation for the two shipbuilding-related local content based policies on various economic indicators. Ultimately, the study provides final remarks and provides policy implications.

2. Estimated Economic Effects of Local Content Requirements

This section describes two local content policies affecting the shipbuilding industry and presents the estimates of their economic impacts. The first estimation simulates the reduction in LCR announced by Brazil's National Agency of Petroleum, Natural Gas and Biofuels (ANP). The second estimation simulates what would happen to the US economy and domestic shipbuilding industry if the long-standing US Jones Act got abolished.

2.1. Brazil's Offshore Oil and Gas Sector Programme

2.1.1. Background

Brazil is the 9th largest oil producer with an exploration volume of 3.3 million barrels per day, accounting for around 3% of global oil production and making up about 22% of volume extracted by the US which is the largest oil producer in 2017 (US Energy Information Administration, 2018[13]). The country's oil and gas industry is regulated by the National Agency of Petroleum, Natural Gas and Biofuels (ANP), which is responsible for ensuring compliance with regulations and oversees contracting. The agency applies local content requirements for the stages of exploration and production development (E&P) of oil and natural gas blocks since the first bidding round in 1999 (ANP, 2018[14]).

The LCR clause is embedded in concession agreements which are contracted between ANP and winning companies. The percentages of local content procurement offered by competing companies count for scoring purposes during the bidding rounds for oil and gas blocks. Concession holders must ensure a preference for contracting Brazilian suppliers as long as price, delivery time and quality are equivalent to foreign supplier companies. This model remained in force until the fourth bidding round in 2002, and has been modified several times resulting in an increasingly complex structure (ANP, 2018[14]).

For the subsequent two rounds in 2003 and 2004, the ANP modified the local content clause in concession contracts and introduced minimum and differentiated percentages for the procurement of Brazilian goods and services used in the exploration of onshore blocks and offshore blocks located in shallow and deep waters.

In the 7th bidding round, that took place in 2005, ANP limited the local content percentages (offered by companies during their bids) to minimum and maximum values. It furthermore established spreadsheets mandating bidding firms to allocate weights and percentages of local content to several items and sub-items for the exploration and development stages.[8]

With the discovery of the immense pre-salt cluster in the Atlantic Ocean off the Brazilian coast in 2005/2006,[9] the local content has been gradually increased. Since the pre-salt oil deposits are located offshore under extremely deep, thick layers of rock and salt they require substantial investment to extract. At the same time, they hold a massive potential for exploration and production. For the pre-salt (i.e. offshore) round the minimum required local content amounted to 37% for the exploration phase, and 55% (59%) for the modules of the development stage to start production by 2021 (by 2022). The ANP did not set a maximum percentage.

In a move to boost oil and gas activities to generate economic growth sufficiently quickly, the ANP recognized the need to relax the LCR in place.[10] In 2017, the National Energy Policy Council (CNPE) defined a new local content system under the CNPE Resolution

No. 02 (as of April 11, 2017) to be applied in the next bidding rounds, starting with the 14th concession round taking place in September 2017.[11] The modifications include a reduction of local content as a scoring factor in bids and a simplification of commitments along with a reduction of the minimum required local content percentages. Box 1 provides further information about Brazil's oil sector and the state-owned oil and gas company Petrobas.

Box 1. Brazil's oil sector

Almost the entire national oil extraction in Brazil takes place in offshore areas of the pre-salt cluster in the south-eastern region of the country (Campos and Santos basins). More than 50% of Brazil's crude-oil production comes from the Campos basin, extracted from six offshore oil-fields (Barracuda, Jubarte, Marlim, Marlim Sul, Marlim Leste and Roncador). The Brazilian state-controlled oil and gas company, Petrobras (Petróleo Brasileiro SA) retains a dominant position in hydrocarbons production despite the loss of its monopoly position in 1997 (OECD, 2014[15]).[12] Yet, the company has enjoyed market protection partly under a law passed in 2010, which required Petrobas to be the lead operator of investments in the 'pre-salt' cluster and to hold a minimum stake of 30% in these projects (The Economist Intelligence Unit, 2016[16]). However, with the amendment of the local content rules in 2016 (Law 13, 365/2016), Petrobas no longer has to be a partner in projects related to the pre-salt cluster (ANP, 2018[17]).

Table 1 sets out the new required local content shares compared to the 13th concession round of December 2015 which was still under the old system. For onshore blocks, only commitments of 50% are required for both the exploration and the production development stages – a reduction of 20 and 27 percentage points, respectively. As far as offshore areas are concerned, the requirement for the exploration phase was reduced from 37% under the previous system to 18% under the new requirement. For the production development stage in offshore projects, the minimum commitments are fixed for three groups: well construction with 25% (prev. 55%), collection and drainage system with 40% (prev. 55%) and stationary production units with 25% (prev. 55%) (ANP, 2018[14]). The contractual commitments as part of these concession contracts (e.g. oil licenses) require oil companies to procure the new minimum percentage of equipment and services from local suppliers.

Table 1. New requirements on oil and gas concessions

	13th Concession Round	New Requirement
Onshore		
Exploration	70%	50%
Development	77%	50%
Offshore		
Exploration	37%	18%
Development:		
Well construction	55%	25%
Collection & Drainage system	55%	40%
Stationary production unit	55%	25%

Source: based on ANP (2018[14]) and Rhodes (2017[18]).

According to ANP, the LCR reform will debottleneck the domestic supply chain due to the reduction in local content fines and the aforementioned new requirements allowing foreign

supplier firms better market access. The country's previous LCR policy was rather complex and international companies had to cope with administrative burdens in documenting LCR-compliant bids in order to obtain an E&P contract in Brazil's oil and gas sector. These obstacles led to a withdrawal of (international) investors from the market and a bottleneck in the domestic supply chain (information obtained from companies). ANP further confirms that the better utilisation of the supply chain would allow a faster development of the 21 billion barrels of oil equivalent (boe) of discovered resources in the pre-salt cluster, which in turn will boost royalty collection and job creation (ANP, 2018[17]).

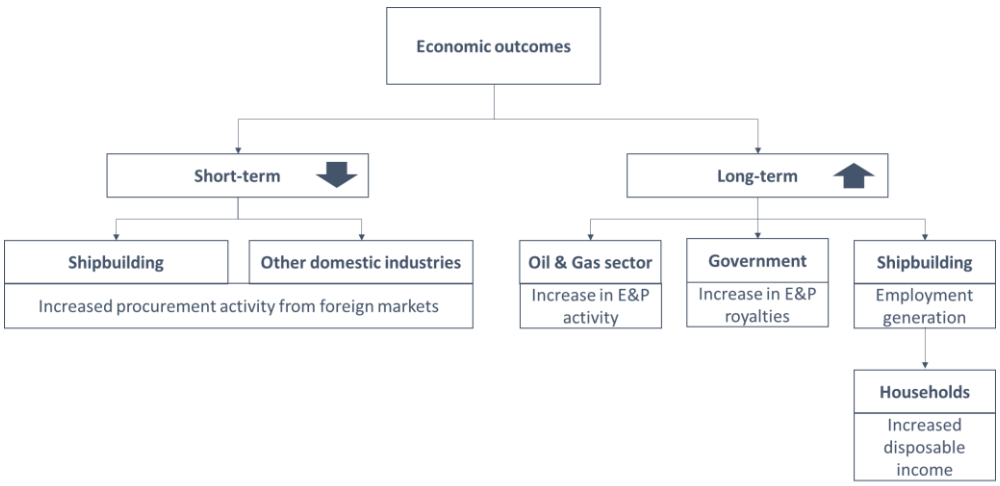
2.1.2. Estimation Strategy and Results

Estimation Strategy

The estimation strategy follows two steps (Figure 1): first, a simulation of the short-term effects of the relaxed sourcing requirements on economic outcomes for the shipbuilding industry, as a supplier industry to Brazil's oil and gas sector, and for Brazil's economy as a whole. For instance, under the new requirements vessel hulls[13] can be built internationally while selected modules are built and integrated locally. This applies in the same way to other supplier industries, where an increasing number of components can now be sourced from foreign markets. In the short-term, Brazil's upstream industries to the oil and gas sector may therefore expect a decline in total output and value added. Table A E.1 in Annex E sets out the local content shares by sector assumed in the simulation.

Second, an analysis of the long-term effects which evidently outweigh the short-term losses as shown in the next section. As a result of the LCR reform, industries can better exploit and utilize the supply chain, which in turn allows a faster development of the discovered resources in the pre-salt cluster, boosting royalty collection and employment creation. Hence, the oil and gas sector can expect increasing E&P activity, the government will thereby increase royalties – a government income which might (partly) be reinvested in the economy, and the shipbuilding industry will create new shipyard positions (ANP, 2018[17]). For the latter aspect, by assuming newly created worker positions in shipbuilding rather than labour flows from other sectors, the Brazilian economy can likely expect an increase in household consumption which in turn generates economic value added.

Figure 1. Effect of Brazil's Local Content Reform on Economic Outcomes



Source: Author's own elaboration.

Estimation Results

Short-term

For the shipbuilding industry in the short-term, the new local content requirements will likely lead to a decline in total output by around USD 328 million (-6.7%) and value added by about USD 82 million (-6.7%). Although it is difficult to derive the increase in orders purely as a consequence of the new requirements, our results indicate that with an increase in vessel production by only USD 327 million (+13%) the short-term losses are expected to be more than offset (Table 2). Considering that this amount equals around three-quarters of the price of one FPSO delivered by Brazil in 2016 (Clarkson World Fleet Register) it might be quite feasible for Brazil's shipbuilding industry to reach this threshold. Besides, the ANP (2018[17]) estimates that around 36 new FPSOs will be built until 2027 as a consequence of the new requirements.[14]

For Brazil's total economy the short-term losses will likely amount to around USD 2.4 billion (-0.1%) in total output and USD 1 billion (-0.1%) in value added as a consequence of the losses incurred by other upstream sectors due to the shift of procurement activity in the downstream sectors to foreign markets.

Long-term

The enormous long-term gains for the Brazilian economy are, however, expected to outweigh the short-term losses, particularly through three channels which are reinforced by a multiplier effect owing to the interconnectedness of economic sectors.

The reduced prices, increased productivity and rise in new demand would more than offset these losses in the long-term. More precisely, only for the oil and gas sector an increase in final demand of USD 1 billion (in total output of USD 1.03 billion and 2.2%)[15] could stimulate Brazil's total economic output by additional USD 1.8 million (+0.06%) likely resulting in an increase in value added of USD 0.5 billion in the sector itself, and of USD 0.9 billion for the total economy. This multiplier effect is a result of the interconnectedness of sectors throughout the economy. To put the figures into perspective: according to ANP (2018[17]) the country can expect a production of around 21 billion barrel of oil equivalent (boe) until 2027 (on average 2.1 billion barrels per year) partly as a consequence of the amended LCR rules in 2018.[16] Brazil's oil production in 2017 reached about 1.2 billion barrels (3.3 million barrels per day according to the US Energy Information Administration (2018[13])), hence 60% of the predicted potential. An increase of only 0.03% of the oil production volume in 2017 at a conventional price of USD 60 per barrel could already offset the short-term losses of USD 2.4 billion in Brazil's total output.

In addition, the policy reform is expected to lead to additional USD 28 billion in royalties collected by the government until 2027 (i.e. USD 2.8 billion per year) (ANP, 2018[17]). Hence, increased government income could (at least partly) propagate throughout the economy in the form of increased government expenditures (if not used to repay public debt). The results show that an increase of USD 1 billion in government spending could trigger off an increase in Brazil's total output of USD 1.4 billion and an increase in Brazil's value added of USD 0.9 billion. In other words, government spending of around USD 1.7 billion (60% of collected royalties per year) could easily compensate for the short-term losses. In addition, against the background of the high government spending relative to public income of more than 100% (i.e. -6% in fiscal balance in 2014 according to OECD (2014[19])) the collected royalties would be very beneficial to the Brazilian government either in the form of investments or debt repayments.

Finally, the ANP (2018[17]) expects a total of 95 000 new shipyard positions. Assuming newly created worker positions in the shipbuilding industry as a result of the LCR reform rather than labour flows from other sectors of the economy, the increase in disposable income is expected to fuel private consumption and thereby increase Brazil's total output and value added in the long-term. The simulation results imply that with an increase of USD 1 billion in household expenditures Brazil's total output may increase by USD 1.6 billion (+0.001%) and its value added by USD 0.9 billion (0.0003%). With the newly created jobs Brazil may expect an increase in household consumption of around USD 1.76 billion[17] and thereby likely outweighing the short-term losses through this third channel (next to the described increase in demand and royalty collections).

Overall, Brazil therefore seems to benefit substantially from opening up its national oil and gas sector to foreign players. The benefits may not only be evident for the total economy, but also for different sectors. Shipbuilding in particular has now the opportunity to benefit from a more outward-focused economic environment supporting industrial development. Brazil's aircraft industry is a prime example of how a sector that is well integrated into global production networks has outpaced an inward-focused assembly industry (Box 2).

Box 2. Brazil's aircraft industry – how openness to trade matters

Brazil has a relatively diversified industrial sector. Yet, while the country's automotive sector faces a rather hard time, its aircraft sector is thriving. The two sectors are two opposite examples with the former one inward-focused and the latter one fully integrated into global trade. In view of the much smaller production volumes of airplanes compared to automobiles, economies of scale require that firms in this industry focus on the global market. Embraer, originally created in 1969 as a state-owned company, was privatized in the 1990s and has become one of the top global players in the industry since then. Its initial strategy was largely based on buying almost all components internationally for a final assembly in Brazil, although over time it has started to produce parts itself. As a result, Embraer has always been strongly integrated into global production chains, and imports still account for 70% of its value added. At the same time, exports have grown steadily, performing significantly stronger than motor vehicle exports. By now, Embraer has become the world's third largest aircraft producer, and the global leader in the 70-130 seat aircraft segment, where it accounts for 60% of global deliveries.

Source: Arnold (2016[20])

Table 2. Simulation results for Brazil

	Notes	Impact on final demand (FD)			Impact on total output (TO)			Impact on total output (TO)			Impact on value added (VA)			Impact on value added (VA)		
Short-term		**Shipbuilding**	USD million	%	**Shipbuilding**	USD million	%	**Economy**	USD million	%	**Shipbuilding**	USD million	%	**Economy**	USD million	%
		Original SB FD	2,512		Original SB TO	4,910		Original ECO TO	3,102,346		Original SB VA	1,229		Original ECO VA	1,646,151	
		New SB FD	2,512		New SB TO	4,582		New ECO TO	3,099,924		New SB VA	1,147		New ECO VA	1,645,070	
		Change in SB FD	0	0.0%	Change in SB TO	-328	-6.7%	Change in ECO TO	-2,422	-0.1%	Change in SB VA	-82	-6.7%	Change in ECO VA	-1,081	-0.1%
	Neutral for SB VA	**Shipbuilding**			**Shipbuilding**			**Economy**			**Shipbuilding**			**Economy**		
		Original SB FD	2,512		Original SB TO	4,910		Original ECO TO	3,102,346		Original SB VA	1,229		Original ECO VA	1,646,151	
		New SB FD	2,838		New SB TO	4,933		New ECO TO	3,100,434		New SB VA	1,235		New ECO VA	1,645,233	
		Change in SB FD	327	13.0%	Change in SB TO	23	0.5%	Change in ECO TO	-1,912	-0.1%	Change in SB VA	6	0.5%	Change in ECO VA	-917	-0.1%
Long-term	Multiplier Effects	**Oil & Gas**			**Oil & Gas**			**Economy**			**Oil & Gas**			**Economy**		
					Original O&G TO	47,206					Original O&G VA	20,083				
		Change in O&G FD	1,000		Change in O&G TO	1,038	2.2%	Change in ECO TO	1,833	0.1%	Change in O&G VA	482		Change in ECO VA	872	
		Government						**Economy**						**Economy**		
		Original Gvt FD	356,529													
		Change in Gvt FD	1,000	0.3%				Change in ECO TO	1,416					Change in ECO VA	939	
		Households						**Economy**						**Economy**		
		Original HH FD	1,113,453													
		Change in HH FD	1,000	0.1%				Change in ECO TO	1,644					Change in ECO VA	868	

Note: Short-term effects are separated into actual estimates and estimates that do not affect the value added in shipbuilding with the removal of the Act. Long-term effects are in the form of multipliers, i.e. a change of 1 000 EUR in final demand in a sector can have an impact of x EUR on total output or value added in the whole economy.
Source: OECD simulation based on OECD Trade-in-Value-Added (TiVA) (2018).

2.2. US Jones Act - Section 27 of the Merchant Marine Act 1920

2.2.1. Background

The Jones Act reserves domestic shipping for vessels that are built, owned, crewed and flagged in the US. It is in force since 1920. The Act's obligations directly affect the shipbuilding and shipping industry through the domestic-built requirement as well as the conditions on employment of a domestic crew and flag registration, respectively. Figure A A.1 in Annex A provides more details about the Act's specific requirements.

The Act includes almost all territory of the US, including Hawaii, Alaska, Puerto Rico, and Guam and temporary exceptions are very limited.[18] Those states and territories, not attached to the mainland US, seem to be most severely affected by the Act because of their long shipping distances from neighbouring US and because their geographical location prevents them from using substitute transportation modes such as trucks, trains, and pipelines. There are, however, some territories, such as the US Virgin Islands, that have been exempt from certain requirements of the law. Almost all ship types are covered by the Act, encompassing oceangoing cargo vessels, barges, ferries, tugboats, small service ships, and passenger vessels. Furthermore, vessels that dredge material used for landfills and those that transport sewage sludge are included, as well as service drilling ships and production platforms for oil and natural gas in the Gulf of Mexico (Grennes, 2017[21]).[19]

The original rationale of the Jones Act goes back to national security concerns, as the Act aimed to enable the American merchant marine fleet to remain viable. In particular, after the significant war losses to the US Merchant Marine Fleet in World War I, the viability of the fleet was a major concern to the US. These reasons are still promoted today although several cases suggest a dependence of the US navy on foreign-built vessels, such as for sealifts, as well as due to capacity constraints (seemingly only one of the five shipyards that produce major vessels for the Navy and Coast Guard builds commercial vessels that are Jones Act compliant).[20] Subsequently, the Act's main purpose moved towards supporting employment and work conditions for American shipbuilders and seamen (Bergstresser and Melitz, 2017[22]).

The debate about the costs and benefits of the Act can be separated into an economic perspective (mainly supported by opponents of the Act) and a political-economy angle (mainly supported by proponents of the Act). The latter one is seemingly more difficult to translate into measurable costs and benefits.

Proponents of the Act reiterate the original purpose of the Act, citing it as necessary to protect the US Merchant Marine and to maintain domestic shipbuilding capabilities. The Navy has repeatedly issued statements to Congress opposing the repeal of the Jones Act, stating that "for decades, US merchant mariners have provided essential support for the U.S. Navy during times of war and national crisis." Furthermore, it is argued that in the interest of national defence, the Act is essential to maintaining a domestic "maritime industrial base of shipyard and repair facilities."

Against the background of an ever-changing geopolitical landscape, there would still exist a need for shipyards and experienced shipbuilders to protect US citizens and the country's economy (Brown Brothers Harriman, 2015[23]). Moreover, labour unions strongly support the Act by viewing it as a means to protect employment. The unions are determined to prevent manufacturing offshoring to foreign markets and thereby have been instrumental in lobbying to save the Act's survival. According to their figures for 2011, the private shipbuilding and repairing industry directly provided 107 240 jobs in the US. The industry

in total – including direct, indirect and induced impacts – was credited with creating 402 010 jobs, USD 23.9 billion of labour income and USD 36 billion in GDP (Maritime Administration (MARAD), 2013[24]).

Opponents emphasize the massive economic net losses of the Act on the overall US economy and in particular on the non-contiguous states and territories of Hawaii, Alaska, Puerto Rico, and Guam.[21] Translating these losses into employment, estimates suggest that every job saved by the Jones Act costs around USD 250 000 with the legislation costing American citizens over 1 billion USD every year (National Public Radio, 2016[25]).[22]

Further studies report that the Act significantly raises transportation costs between American ports. As of November 2018, the US merchant fleet includes around 3 000 vessels, but around 90% of them are tug boats, dredgers or small offshore ships rather than transport-efficient oceangoing vessels (Clarkson Research World Fleet Register, 2018).[23] Since US ships must operate under a crew comprising 75% American citizens, the operating costs of a Jones Act eligible ship are around 2.7 times that of a foreign-flagged vessel. The elevated costs are primarily a result of the higher living standards, wage rates and social benefits of the US crew (US Maritime Administration (MARAD), 2011[26]). Another study commissioned by MARAD highlight that higher labour costs contribute to additional USD 12 000 to USD 15 000 per day to operating cost differentials between US and foreign-flag vessels (PwC, 2011[27]). The US shipping industry has seemingly struggled to compete on the international market, and Jones-Act eligible ships are used primarily for domestic transportation services. As a result of elevated costs and low demand for US shipping services the average age of the US merchant fleet is almost 30 years, as of November 2018 (Clarkson Research World Fleet Register, 2018).

According to a study by the Congressional Research Service the cost of shipping crude oil from Texas to refineries in the East Coast is considerably more expensive per barrel than shipments to much more distant locations (Frittelli, 2014[28]).[24] In 2012, the Federal Reserve Bank of New York found that shipping cost for a twenty-foot container from the US mainland to Puerto Rico was USD 3 063, but only half for the same container from the US mainland to the Dominican Republic (Federal Reserve Bank of New York, 2012[29]). Overall, the World Economic Forum (2013[30]) estimates that preventing foreign ships from transporting cargo between US ports costs the US economy USD 200 million per year in extra shipping costs.

In addition, research outcomes show that the provision of the Act's domestic built-requirement results in increased ship prices. For example, the Congressional Research Service estimates that oil tankers built in the US are about four times more expensive than those built abroad (Frittelli, 2014[28]). An article by Brown Brothers Harriman (2015[23]) reports that Matson Incorporated placed a 418 million USD order for two Jones Act ships with prices about five times what it would have cost to build the tankers in Asia. Furthermore, the contract price of USD 250 million for two vessels purchased by Philly Tankers AS was more than three times what comparable ships constructed in Vietnam would have cost (Bergstresser and Melitz, 2017[22]).

It is the goal of this paper to provide more insights into the economic effects of the abolition of the Jones Act on the US shipbuilding industry and the overall US economy. To do so, we use a static Inter-Country Input Output model and use the information provided above for our simulation assumptions. Our simulation approach is most closely related to Francois et al. (1996[11]). The authors use an Applied General Equilibrium (AGE) model to estimate the effects of a hypothetical repeal of the Act on the US economy in terms of welfare, production, trade and employment. The focus of the model lies on the cabotage and water

transportation sectors which are directly affected by the Jones Act, as well as a selection of sectors that have significant up- and downstream linkages to cabotage services, including shipbuilding, or to petroleum and refined petroleum products and other transportation sectors. This approach differs from our work in two ways. First, the authors' approach does not assess the increase in final demand, output and value added of other US economic sectors – that are not directly linked to cabotage services but are dependent on water transportation services for intra-US sales – due to a decrease in output prices in these sectors caused by lower water transportation costs. In other words, our approach goes beyond the study's quantitative assessment by estimating the economic effects of an increase in intra-US trade in US sectors stimulated by the reduction of water transportation costs as a consequence of the Act's removal. In particular this additional effect can explain the difference in estimation results on the US economy between the study by Francois et al. (1996[11]) and our work. Second, our approach simulates the direct effects of the Act's US built-requirement for ships on the shipbuilding sector itself. These are some of the novelties brought about by the modelling approach of this work presented in the following section.

2.2.2. Estimation Strategy and Results

Estimation Strategy

The simulations are based on the rationale that the exposure of firms to greater competition results in aggregate productivity gains and lower mark-ups which may be reflected in reduced prices (in the case of full cost-pass-through). These channels are supported by empirical research results. Box 3 summarizes results discussed in the research literature about the effect of international competition on firm productivity and prices.

Box 3. International competition and productivity

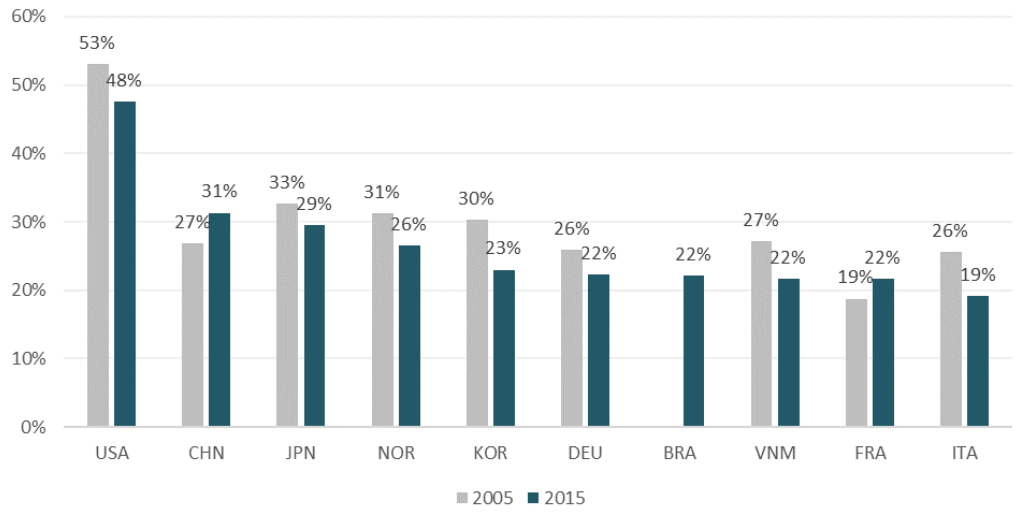
Empirical results show that by exposing producers to greater competition, international trade can lead to aggregate productivity gains. The effect of cost-reductions (as a result of increased competition) on prices depends on the cost-pass-through on the producers' side. Although increased competition may lower prices, firms can offset this reduction by raising mark-ups (De Loecker et al., 2016[31]). With the fall of trade barriers exposing firms to more intense competition, aggregate industry productivity rises as less productive firms exit the market and the remaining firms expand (Melitz (2003[32]); Pavcnik (2002[33])), and thereby take advantage of cheaper or more competitive goods that were previously unavailable in the domestic market (e.g. Goldberg et al. (2010[34]); Amiti and Konings (2007[35]) on Indonesia's trade reform; Halpern, Koren and Szeidl (2015[36]) on Hungary; Brandt et al. (2017[37]) on China; Edmond, Midrigan and Yi (2015[38]) on Chinese Taipei). Melitz and Ottaviano (2008[39]) show in their model how exposure of firms to stronger competition results in higher aggregate productivity and lower average mark-ups.

Abolishing the Jones Act will expose US ship producers to intensified international competition. US shipbuilders thus need to adjust prices (and thereby profits) to global levels and increase industrial productivity in order to remain competitive. Since value added is measured as the sum of operating surplus (i.e. profits), employee compensation (salaries),

depreciation of fixed capital and net taxes on production (less subsidies), [25] the adjustment effect of reduced profits will be echoed in a decline in value added in the short-term. The required increase in US firm productivity will furthermore be revealed in a rise in output value (either through increased production or product quality) in the long-term.[26] These adjustment effects will likely appear in different guises. Nevertheless, in sum these channels are reflected in the reduction of the US ratio of value added over output (48% in 2015) to an international (weighted) average (31.2%).

Latest OECD research on global value chains in the shipbuilding industry (Gourdon and Steidl, forthcoming[12])highlights the striking difference of US value added as share of ship production value compared to other shipbuilding economies (Figure 2). While the ratio amounts to 20% to 30% in most of the shipbuilding nations, the US stands out with a share of 48% in 2015 – which could be an indication of inflated profits and prices likely as a result of local content policies.[27]

Figure 2. Shipbuilding value added over final output



Note: Results for Brazil are omitted for the year 2005 because of data limitations.
Source: Gourdon and Steidl (forthcoming[12]).

Figure 3 illustrates the different channels the simulation is based on. As elaborated in the previous section, US built ships are two to five times more expensive than foreign-built vessels.[28] Opening up the US shipbuilding industry will thus require shipbuilders to reduce vessel prices by at least 50% to converge to international levels in order to remain competitive.

Such a reduction in ship prices will likely trigger new demand for US ships. The simulations assume elastic demand for ships between 1.2 to 1.6, implying that a reduction in US ship prices by 50% may lead to an increase of 60% to 80% in ship demand. A sensitivity analysis (described in more detail in Annex D with results in Table A D.1) with respect to demand elasticity shows that up to a unit elasticity (i.e. 1) the overall US economy can expect positive economic growth and the shipbuilding industry a positive value added following the abolishment of the Act.

In addition, reduced ship prices represent reduced capital costs for shipping companies which in turn can offer cheaper transportation services. In scenario 1, by reducing only

capital costs (i.e. keeping operational and other shipping costs constant) the model implied (endogenous) results show a reduction in prices for domestic water transportation services (i.e. freight rates) of around 14.7%.

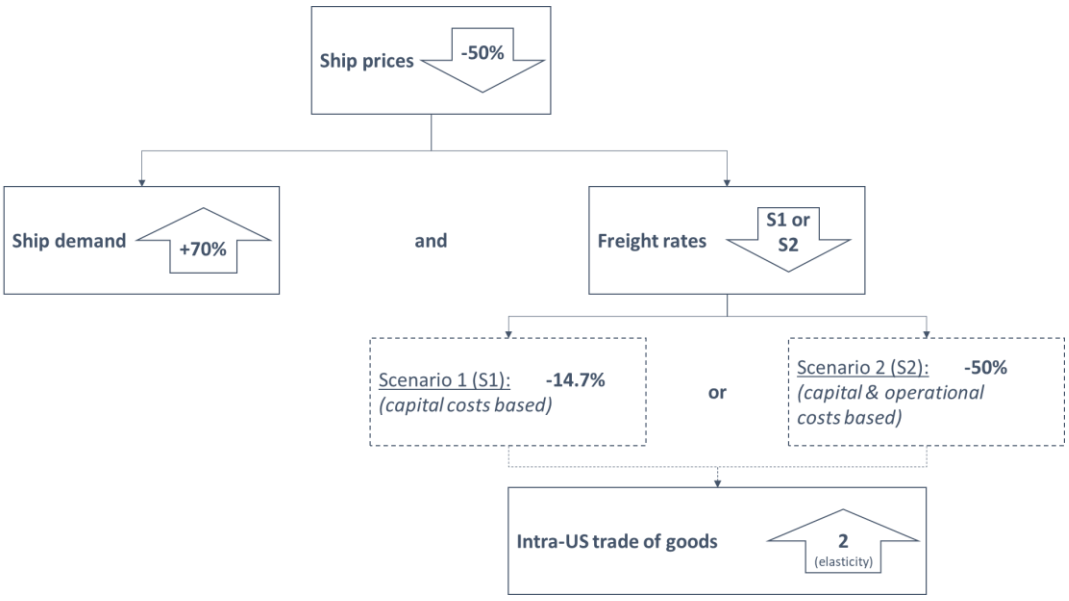
Separately, scenario 2 is based on research results discussed in the previous section implying that the requirement to use a ship in conformity with the Jones Act leads to freight rates that are at least two times higher. As a consequence of the Act's abolishment, freight rates will hence decrease by around 50% to approximate water transport costs associated with foreign ships. In other words, scenario 2 comprises the reduction in freight rates as a consequence of both reduced capital and operational costs.[29]

Finally, several econometric studies show the significant effect of changes in water transportation costs on trade flows. Limao and Venables (2001[40]) find an elasticity of trade with respect to freight costs in the range of -2 and -3.5 and Behar and Venables (2011[41]) of -3. Clarke, Dollar and Micco (2004[42]) estimate for country-specific transport costs an elasticity of -1.3. For both scenarios in our simulation, the elasticity of intra-US (domestic) maritime trade with respect to freight rates is initially set to the level of -2%. In other words, a reduction (increase) in freight rates of 1% will result in an increase (reduction) in the demand for water transportation services of 2%.[30]

A sensitivity analysis (described in more detail in Annex D and results in Table A D.1) shows how robust the conclusions are to the assumptions made on reductions in freight rates (as a result of cheaper vessels) and the increase in intra-US seaborne trade (i.e. trade elasticities). By assuming very conservatively either a reduction in freight rates of 1.4% coupled with an elasticity of trade of -2 (as set in the model), or a reduction in freight rates by 14.7% (only based on capital costs) coupled with an elasticity of trade of -0.2 (very inelastic) the results show positive net gains for the total US economy.

As illustrated in the following, even on the basis of very conservative assumptions made (which are far less strict than reported in previous research), an abolishment of the Act will result in net economic gains for the US, in particular for US industries dependent on water transportation services for intra-US sales, and the shipbuilding industry itself.

Figure 3. Overview of simulation assumptions



Source: Author's own elaboration.

Estimation Results

The estimation results reveal large benefits for the US economy in total; not only for other US industries but also in the long-term for the US shipbuilding industry itself.[31] The results refer to the economic gains in the long-term such that the US economy will have structurally adjusted to the shock associated with the abolition of the Act, i.e. the shipbuilding industry will have reached international productivity levels, water transportation services will have approached the price levels of non-Jones Act conform vessels, and intra-US maritime trade will have been stimulated by lower freight rates.

In both simulation scenarios (Table 3), the US commercial shipbuilding industry has the potential to increase its final demand by around 70% from approximately USD 841 million to USD 1.43 billion and its total output by about 71% from USD 859 million to USD 1.47 billion. Despite the repeal of the local content requirement the domestic US shipbuilding industry can largely benefit as reflected in the increase in value added of around USD 44 million (from previous USD 412 million). This is the result of the increased number of new ship orders following the reduction in sales prices. A sensitivity analysis with respect to demand elasticity shows that up to a unit elasticity (i.e. 1) the shipbuilding industry can still expect gains in value added following the abolishment of the Act (Table A D.1).

The total US economy may benefit from an increase in final demand in the range of USD 22 billion (scenario 1) and USD 74 billion (scenario 2) which represent a rise between 0.12% and 0.39% in the long-term. US total output is likely to increase between USD 40 billion (0.1%) and USD 135 billion (0.4%). In terms of domestic value added the results amount to around USD 19 billion and USD 64 billion, making up an increase of around 0.1% to 0.36% for the total US economy.

The effect on the total US economy is largely a result of the increase in industrial activity of other sectors. The reduced freight rates will stimulate demand for intra-US trade (using water transportation services), thereby benefitting overall US economic growth. In 2015, domestic final demand of US industries using water transportation services amounted to

around USD 74 billion. Final demand of other US industries in total (i.e. serving the domestic and foreign market by using all kinds of transportation modes) reached USD 18.9 trillion. Throughout the report, the comparison for economic growth will be made with respect to the latter one, hence, with other US industries in total. It is worth highlighting that the estimation results reported by Francois et al. (1996[11]) do not include this additional effect on other sectors due to the increased demand stimulated by lower water transportation costs, and they are therefore lower than the outcomes under the following two scenarios.[32]

In scenario 1, US industries may generate additional final demand of almost USD 22 billion (+0.11%), and further output of approximately USD 40 billion (+0.13%), which represent respectively more than 37 and 65 times the original US commercial shipbuilding industry prior to the Act's removal. The removal could furthermore generate additional domestic value added in other US industries. Those can expect an increase of about USD 19 billion (+0.11%) which equals 439 times the volume generated in the commercial US shipbuilding industry under the Jones Act.

In scenario 2, other US industries can expect an increase in final demand of about USD 74 billion (+0.4%), and further output of approximately USD 134 billion (+0.4%), which represent respectively two times and three times the size of the original US shipbuilding industry under the Act. The abolition may also create domestic value added in other US industries. Those can expect an increase of about USD 66 billion (+0.4%) which is 219 times the value added originally generated in the shipbuilding industry.

The dimensions are extreme, simply by virtue of comparing US industries of immense size serving the domestic US market with the usage of water transport services, with the US commercial shipbuilding industry representing only a small sector in the US economy.

From an economic perspective, the Act evidently creates large cost inefficiencies by protecting the shipbuilding industry – a tiny economic sector in the US – at the expenses of other US industries with enormous economic potential. Our results are a "mirror image" of previous research outcomes on the estimation of economic costs as a consequence of the Jones Act. With the abolishment of the Act the associated gains will in the long-term more than compensate the initial losses incurred by the US shipbuilding industry through the illustrated economic adjustment processes.

Table 3. Estimation results

Scenario 1: Model implied transport cost reduction (capital costs);

Scenario 2: Cost reductions based on research outcomes (capital and operational costs)

	Scenario 1			Scenario 2		
	Impact on final demand (FD)			Impact on final demand (FD)		
US Shipbuilding*	**USD million**	**%**	**Impact**	**USD million**	**%**	**Impact**
Original shipbuilding FD	841			841		
New shipbuilding FD	1,430			1,430		
Change in shipbuilding FD	589	70%		589	70%	
US Other Industries						
Original other industries FD	18,938,603			18,938,603		
New other industries FD	18,960,367			19,012,572		
Change in other industries FD	21,764	0.11%	37.0	73,969	0.39%	126
Total US Economy						
Total original US FD	18,939,444			18,939,444		
New total US FD	18,961,797			19,014,002		
Change in US FD	22,353	0.12%	38.0	74,558	0.39%	126.6
	Impact on total output (TO)			Impact on total output (TO)		
US Shipbuilding*	**USD million**	**%**	**Impact**	**USD million**	**%**	**Impact**
Original shipbuilding TO	859			859		
New shipbuilding TO	1,471			1,471		
Change in shipbuilding TO	612	71.21%		612	71.21%	
US Other Industries						
Original other industries TO	30,819,990			30,819,990		
New other industries TO	30,860,079			30,954,389		
Change in other industries TO	40,089	0.13%	65.5	134,399	0.44%	219.7
Total US Economy						
Total original US FD	30,820,849			30,820,849		
New total US FD	30,861,550			30,955,860		
Change in US FD	40,701	0.13%	66.5	135,011	0.44%	220.7
	Impact on value added (VA)			Impact on value added (VA)		
US Shipbuilding*	**USD million**	**%**	**Impact**	**USD million**	**%**	**Impact**
Original shipbuilding VA	412			412		
New shipbuilding VA	456			456		
Change in shipbuilding VA	44	10.61%		44	10.61%	
US Other Industries						
Original other industries VA	17,638,457			17,638,457		
New other industries VA	17,657,662			17,702,774		
Change in other industries VA	19,205	0.11%	439.6	64,317	0.36%	1472
Total US Economy						
Total original USA VA	17,638,869			17,638,869		
New total USA VA	17,658,118			17,703,229		
Change in USA VA	19,249	0.109%	440.6	64,361	0.37%	1473

Note: *refers to commercial US shipbuilding only (i.e. excludes military production).
Source: OECD simulation based on OECD Trade-in-Value-Added (TiVA) (2018).

3. Final remarks

This study quantifies the significant economic gains that are expected to be revealed through the abolition or relaxation of local content based policies. The work analyses two specific local content policies affecting directly or indirectly the shipbuilding industry in two countries: Brazil's local content requirement as part of national concession contracts in the oil and gas sector, and the long-standing US Jones Act obliging intra-US seaborne trade to be conducted on US built and US flagged vessels.

By exploiting the Inter-Country Input-Output (ICIO) framework of OECD's Trade-in-Value-Added (TiVA) database, the applied static model simulates the impacts of the two policies on the sector itself, as well as for the economy more generally. The results for Brazil reveal the enormous gains expected with the reduction in its protectionist measure. The results for the US illustrate the unrealized potential the economy could exploit should the US Jones Act be abolished.

Overall, the study mirrors the negative economic effects of localisation based policies. Should governments require new policy tools for employment creation, industrial and/or technological development, there are more efficient alternatives to LCRs that could achieve these objectives. For instance, governments can help stimulate employment generation through a stable macroeconomic framework as well as certain structural policies which encourage innovation, skills and business development. Moreover, governments need to respond to skills gaps that may act as barriers and obstacles to economic growth, such as by offering flexible training, education and employment services (OECD, 2014[43]). Besides, improved logistics can reduce trade transaction costs, and can make firms more competitive internationally and at the same time create additional jobs. Also, infrastructure investment is critical for economic performance and generating domestic employment, but require lower economic costs than the detrimental economic effects revealed through local content policies (Hufbauer et al., 2013[3]). The core factor of any such policy is that it is designed to resolve these development obstacles rather than distorting prices.

For future research it would be interesting to understand the results in the context of adjustments of trade flows with third economies – a relevant topic when considered in light of global value chains.

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Annex A. Details about the US Jones Act

For a US-flagged vessel to be qualified to engage in US coastwise trade (46 USC 55102(b)), originally section 27 of the Merchant Marine Act, 1920, as amended Jones Act trade)) and qualify for a coastwise endorsement on its certificate of documentation it must be, inter alia:

- built in the United States and
- owned by entities whose chief executive officer, president and chairman of the board of directors (and anyone that can act in their absence or disability) must be US citizens, and whose equity is at least 75 per cent held (of record and beneficially) by US citizens,
- with 75% of US crew,
- registered under US flag.

Built in the US criteria:

A vessel is deemed to be built in the US only if all major components of the hull and superstructure are fabricated in the US and the vessel is entirely assembled in the US (46 CFR 67.97).

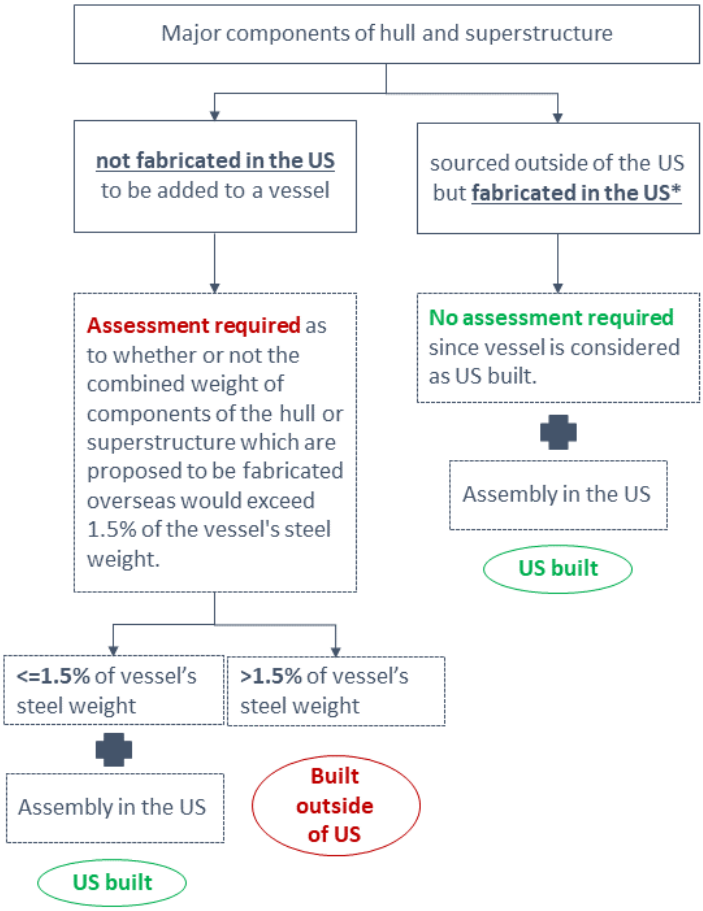
The US Coast Guard has consistently held that items not integral to the hull or superstructure, such as propulsion machinery, consoles, wiring harnesses and other outfitting that has no bearing on a US build determination, may be foreign-built without compromising the vessel's coastwise eligibility.

The US Coast Guard has also held that foreign components amounting to less than 1.5 per cent of a vessel's steel weight are not considered 'major'. Within these confines the shipbuilding contract and the vessel's specifications should permit foreign-sourced materials and equipment to be incorporated in the vessel without adversely affecting the vessel's qualification for a coastwise endorsement on its certificate of documentation (van Steenderen, 2018[44]).

Figure A A.1 provides an overview of the requirements for a ship to qualify for being built in the US. As long as major components of the vessel’s hull and superstructure are fabricated in the US these components can be imported from outside of the US. However, once a major component of the hull and superstructure imported weights more than 1.5% of the vessel’s steel weight it fails to fulfil the US built criteria. In this case, ship owners will not be allowed to operate the vessel in intra-US maritime transport.

Taken together, this suggests that US shipbuilders aren’t required to source intermediate inputs domestically to fulfil the LCR as long as they fabricate the major components of the hull and superstructure and assemble the vessel in the US.

Figure A A.1. Built in the US criteria



Note: *e.g. major components of hull and superstructure that are purchased from foreign steel manufacturers in standard lengths, widths and shapes and are not custom designed or fabricated for use in the vessels.
Source: based on US Department of Home Security (2017[45])

Annex B. Ships produced in the US during 2016

There are a total of 106 different ships which are at least partly produced during 2016. These ships were ordered in 2014, 2015 or 2016 and delivered during the subsequent years. Table A B.1 provides more details about the vessel types ordered and produced during 2016.

Table A B.1. Ships produced in the US during 2016

Vessel Types	Contract Year	Delivery Year	Frequency
Anchor Handling Tugs & Supply	2014	2018	1
Anchor Handling Tugs & Supply	2014	2019	1
Anchor Handling Tugs & Supply	2015	2017	3
Anchor Handling Tugs & Supply	2016	2018	2
Cruise 2-59,999 GT	2015	2017	1
Cruise 2-59,999 GT	2015	2018	1
Dredgers <2,000 GT	2016	2017	1
Handy Products Tankers 10-54,999 dwt	2015	2017	2
Miscellaneous Types <2,000 GT	2015	2016	1
Miscellaneous Types <2,000 GT	2016	2017	1
Other Offshore	2015	2016	2
Other Offshore	2016	2018	1
Passenger Ferries 2-9,999 GT	2014	2018	1
Passenger Ferries 2-9,999 GT	2014	2019	1
Passenger Ferries 2-9,999 GT	2015	2018	1
Passenger Ferries <2,000 GT	2015	2016	1
Passenger Ferries <2,000 GT	2015	2017	2
Passenger Ferries <2,000 GT	2015	2018	2
Passenger Ferries <2,000 GT	2016	2017	10
Passenger Ferries <2,000 GT	2016	2018	7
Passenger Ferries <2,000 GT	2016	2019	2
Ro-Ro 10,000+ dwt	2016	2019	1
Ro-Ro 10,000+ dwt	2016	2020	1
Tugs <2,000 GT	2014	2016	2
Tugs <2,000 GT	2015	2016	5
Tugs <2,000 GT	2015	2017	11
Tugs <2,000 GT	2015	2018	8
Tugs <2,000 GT	2016	2017	6
Tugs <2,000 GT	2016	2018	26
Tugs <2,000 GT	2016	2019	2

Source: based on Clarkson World Fleet Register (2018).

Annex C. Estimation of output value of US commercial shipbuilding industry

We derive the value of each vessel produced on the basis of the weighted average newbuilding prices for contracts realized in 2015 as shown in Table A C.1. Offshore have the highest value followed by passenger ferries, dredgers, anchor handling tugs & supply, cruise ships, handy products tanker, Ro-Ro, smaller passenger ferries, tugs and the miscellaneous category.

Table A C.1. Newbuilding prices per cgt

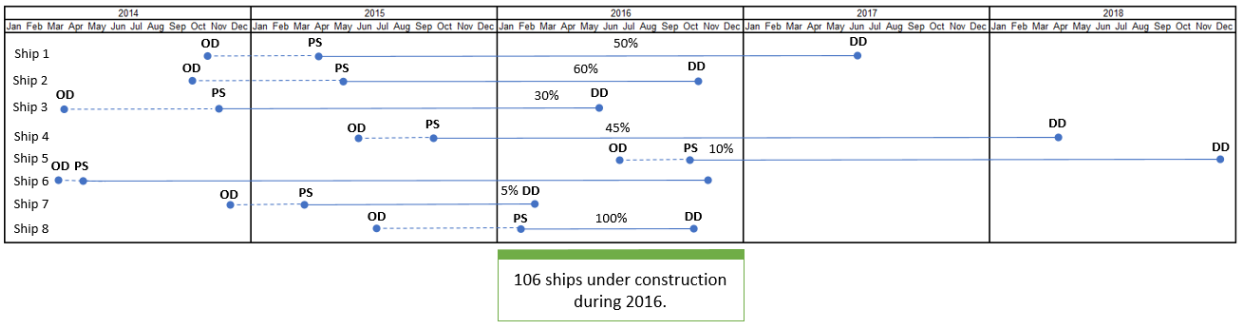
Weighted average of available prices by year

Vessel Types	2015	Note
Other Offshore	0.021	**from 2013**
Passenger Ferries 2-9,999 GT	0.014	
Dredgers <2,000 GT	0.009	**from 2011**
Anchor Handling Tugs & Supply	0.006	**from 2012**
Cruise 2-59,999 GT	0.005	
Handy Products Tankers 10-54,999 dwt	0.005	**from 2014**
Ro-Ro 10,000+ dwt	0.005	**from 2016**
Passenger Ferries <2,000 GT	0.003	global from 2016
Tugs	0.002	global from same year
Miscellaneous Types <2,000 GT	0.001	global from 2005

Note: bolt-highlighted prices were reported for US produced ships (i.e. no imputation) or has been imputed from observations of historical US produced vessels (specified in the note). Prices for passenger ferries, tugs and miscellaneous types were imputed from weighted average prices from other countries.*
Source: based on Clarkson World Fleet Register, 2018.

Since we are only interested in the value of ships produced during the year 2016, and ship production usually takes place over several years, we derive the individual production value by allocation the production share per month. The allocation exercise is based on information provided by ship yards, and Figure A C.1 provides for illustration purposes an indicative production plan. Table A C.2 presents the results of production values by ship type, amounting to a total of around USD 841 million for the production of commercial ships.

Figure A C.1. Indicative production plan



Note: OD=order date of ship (=contract signing); PS=production start; DD=delivery date.
Source: Author's own elaboration.

Table A C.2. Production of US ships in 2016

Vessel Types	Cgt produced	No of ships produced	Value in million USD produced
Anchor Handling Tugs & Supply	5,089	2.4	29
Cruise 2-59,999 GT	17,793	1.9	92
Dredgers <2,000 GT	2,498	0.8	22
Handy Products Tankers 10-54,999 dwt	46,796	1.9	241
Miscellaneous Types <2,000 GT	555	0.5	0
Other Offshore	6,600	0.9	135
Passenger Ferries 2-9,999 GT	10,253	1.3	132
Passenger Ferries <2,000 GT	14,388	7.7	41
Ro-Ro 10,000+ dwt	876	0.03	7
Tugs <2,000 GT	56,347	29.7	140

Note: Figures may vary due to rounding.
Source: based on Clarkson's World Fleet Register (2018).

Annex D. Sensitivity analysis

Table A D.1 presents the results of a sensitivity analysis with respect to the assumptions made. The sensitivity analysis reveals that with a unit demand elasticity (i.e. of 1), where a price reduction of 1% leads to an increase in final demand for ships of around 1%, will still result in net gains for the US economy as a whole. In this simulation, the shipbuilding industry will not incur any losses in value added since the increase in ship orders will outweigh the price reductions.

Again, other US industries using water transportation services for their intra-US trade (i.e. domestic sales) can expect large benefits as a result of the reduced water transportation costs stimulating demand for their goods. The simulation tests the sensitivity of the assumption of price reductions in water transport services (i.e. freight rates) on the results. Even with a small reduction of 1.47% in freight rates the abolishment of the Act will still generate economic gains for the US and in particular for US industries dependent on intra-US sales. Against the background of the largely inflated freight costs for Jones Act conform ships as reported in various studies (i.e. observing freight rates twice as high as of foreign-built and operated ships), the assumption of a reduction in freight rates by only 1.47% is extremely underestimated, making the simulation results tremendously conservative. In particular, states and territories not attached to the mainland US (i.e. Puerto Rico, Hawaii etc.) will benefit the most from the abolishment of the Act. In the view of their dependence on US goods and services they will likely increase their demand following the reduction in trade costs.

In sum, even on the basis of very conservative assumptions made, an abolishment of the Act will result in net economic gains for the US, in particular other US industries dependent on water transportation services for intra-US sales, and the shipbuilding industry itself.

Table A D.1. Sensitivity of results to assumption on demand elasticity

Impact on final demand (FD)			
US Shipbuilding*	USD million	%	Impact
Original shipbuilding FD	841		
New shipbuilding FD	1,295		
Change in shipbuilding FD	454	54%	
US Other Industries			
Original other industries FD	18,938,603		
New other industries FD	18,940,779		
Change in other industries FD	2,176	0.01%	5
Total US Economy			
Total original US FD	18,939,444		
New total US FD	18,942,074		
Change in US FD	2,631	0.01%	5.8
Impact on total output (TO)			
US Shipbuilding*	USD million	%	Impact
Original shipbuilding TO	859		
New shipbuilding TO	1333		
Change in shipbuilding TO	473	55.09%	
US Other Industries			
Original other industries TO	30,819,990		
New other industries TO	30,824,564		
Change in other industries TO	4,574	0.01%	9.7
Total US Economy			
Total original US FD	30,820,849		
New total US FD	30,825,896		
Change in US FD	5,047	0.02%	10.7
Impact on value added (VA)			
US Shipbuilding*	USD million	%	Impact
Original shipbuilding VA	412		
New shipbuilding VA	412.8		
Change in shipbuilding VA	1	0.20%	
US Other Industries			
Original other industries VA	17,638,457		
New other industries VA	17,640,669		
Change in other industries VA	2,212	0.01%	2741
Total US Economy			
Total original USA VA	17,638,869		
New total USA VA	17,641,082		
Change in USA VA	2,213	0.01%	2742

Note: *refers to commercial US shipbuilding only (i.e. excludes military production).
Source: OECD simulation based on OECD Trade-in-Value-Added (TiVA) (2018).

Annex E. Brazil's Local Content Shares

Table A E.1. Brazil's local content shares by sector – original and new

Industry Code	Industry Description Code	Industry Description	Original domestic share	New domestic share
D01	AGR	Crop and animal production, hunting and related service activities	83.6	83.5
D02	FOR	Forestry and logging	97.6	97.6
D03	FSH	Fishing and aquaculture	88.2	88.2
D05	COL	Mining of coal and lignite	0.7	0.6
D06	OIL	Extraction of crude petroleum and natural gas	70	69.9
D07	ORE	Mining of metal ores	19.2	19.1
D08	QUA	Other mining and quarrying	90.7	90.7
D09	MSR	Mining support service activities	0	0.0
D10	FOD	Manufacture of food products	91.8	48.6
D11	BEV	Manufacture of beverages	92.6	49.1
D12	TOB	Manufacture of tobacco products	73	38.6
D13	TXT	Manufacture of textiles	81.8	43.3
D14	APP	Manufacture of wearing apparel	77.7	41.8
D15	LTH	Manufacture of leather and related products	90.7	48.1
D16	WOD	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	97.5	51.6
D17	PAP	Manufacture of paper and paper products	91.2	48.3
D18	PRI	Printing and reproduction of recorded media	92.1	48.7
D19	PET	Manufacture of coke and refined petroleum products	92.8	49.1
D20	CHM	Manufacture of chemicals and chemical products	78.2	41.4
D21	PHR	Manufacture of basic pharmaceutical products and pharmaceutical preparations	36.2	18.4
D22	RUB	Manufacture of rubber and plastics products	86.1	45.6
D23	NMT	Manufacture of other nonmetallic mineral products	92.6	49.0
D241_2431	FRO	Manufacture of iron and steel	85.6	45.3
D242_2432	NFR	Manufacture of non-ferrous metals	83.4	44.2
D25	MET	Manufacture of fabricated metal products, except machinery and equipment	86.8	46.0
D26	COM	Manufacture of computer, electronic and optical products	64.5	34.1
D27	ELE	Manufacture of electrical equipment	74.4	39.4
D28	MCH	Manufacture of machinery and equipment n.e.c.	70.9	37.6
D29	MOT	Manufacture of motor vehicles, trailers and semitrailers	90.3	47.7
D301	SHP	Manufacture of Ships	58.5	30.9
D302T309	OTE	Manufacture of other transport equipment	88.6	46.9
D31T32	OMN	Manufacture of furniture; manufacturing nec	86.6	45.9
D33	REP	Repair and installation of machinery and equipment	94.1	49.8

Industry Code	Industry Description Code	Industry Description	Original domestic share	New domestic share
D35	UTL	Electricity, gas, steam and air conditioning supply	97.4	51.61
D36	WAT	Water collection, treatment and supply	98.1	51.99
D37T39	WST	Sewerage; Waste collection, treatment and disposal activities; materials recovery; and remediation activities and other waste management services	96.8	51.31
D41T43	CON	Construction	91.1	48.25
D45	RMO	Wholesale and retail trade and repair of motor vehicles and motorcycles	65.8	34.83
D46	WHO	Wholesale trade, except of motor vehicles and motorcycles	88.4	46.84
D47	RET	Retail trade, except of motor vehicles and motorcycles	93.8	49.68
D49	LTN	Land transport and transport via pipelines	93.5	49.54
D50	WTN	Water transport	57.1	30.25
D51	ATN	Air transport	81.4	43.14
D52	STN	Warehousing and support activities for transportation	91.8	48.45
D53	POS	Postal and courier services	99.2	52.58
D55	HTL	Accommodation	99.1	52.50
D56	RES	Food and beverage service activities	99.8	52.88
D58	PUB	Publishing activities	75.9	40.21
D59T60	BRO	Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	95	50.34
D61	TEL	Telecommunications	98.4	52.13
D62T63	SOF	Computer programming, consultancy and related activities	69.1	36.56
D64	FIN	Financial service activities, except insurance and pension funding	93.9	49.77
D65	INS	Insurance, reinsurance and pension funding, except compulsory social security	96.6	51.18
D66	AUX	Activities auxiliary to financial services and insurance activities	97.4	51.63
D68A	ESTA	Imputed rents	0	0.00
D68B	ESTB	Real estate activities	98	51.92
D69T70	LEG	Legal and accounting activities; activities of head offices; management consultancy activities	93.4	49.51
D71	ACH	Architectural and engineering activities; technical testing and analysis	85.2	45.13
D72	RND	Scientific research and development	5.4	2.85
D73	ADV	Advertising and market research	96	50.86
D74T75	OSC	Other professional, scientific and technical activities; veterinary activities	80.3	42.53
D77	LEA	Rental and leasing activities	57.8	30.59
D78	EMP	Employment activities	98.8	52.33
D79	TRA	Travel agency, tour operator reservation service and related activities	93.6	49.62
D80T82	OSR	Security and investigation activities, services to buildings and landscape activities; and office administrative, office support and other business support activities	80.9	42.82
D84	GOV	Public administration and defence; compulsory social security	98.3	52.07
D85	EDU	Education	77.7	41.25
D86	HLT	Human health activities	98	51.93
D87T88	SOC	Residential care activities and social work activities without accommodation	64.2	34.04

D90T92	ART	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	53.3	28.25
D93	SPO	Sports activities and amusement and recreation activities	63.6	33.73
D94	MEM	Activities of membership organisations	99.8	52.88
D95	PRP	Repair of computers and personal and household goods	99.8	52.88
D96	OPR	Other personal service activities	85.8	45.47
D97T98	HCA	Activities of households as employers; undifferentiated goods and services producing activities of households for own use	0	0.00

Source: based on OECD Trade-in-Value Added (2018).

Endnotes

[1] Weiss (2016[6]) provides a more detailed overview of arguments for local content policies, such as (i) *economic benefits* by achieving sectoral development in fast growing sectors and benefitting from an increased tax base for governments; (ii) *the infant industry argument* where domestic producers achieve economies of scale more rapidly, reducing unit costs and resulting in a more cost efficient and competitive industry. This explanation also includes the argument that governments seek a legitimization for their public support to infant industries that require large upfront investments, such as it is the case in the renewable energy sector. The high financial burden might not be publicly supported if there were no local benefits attached to it (Kuntze and Moerenhout, 2013[46]); (iii) *technology transfer* from foreign to domestic firms so the quality of the final product (despite using local inputs) does not suffer. Domestic firms are able to engage in learning by doing and absorbing knowledge capacity, which may make them more competitive in the long-term.

[2] Between 2010 and 2012, G20 countries put an additional 265 local content requirements in place. The increase is particularly related to implementations in G20 countries in the IMF classification "G20 emerging and developing economies" (UNCTAD, 2017[48]).

[3] These so-called offsets requirements are for instance only authorized under the WTO Government Procurement Agreement (GPA) for developing countries during transitional periods.

[4] In the context of public procurement provisions, Hufbauer et al. (2013[3]) claim that LCRs are "the norm rather than the exception".

[5] The ideal choice (in the market equilibrium) would stipulate that local producers of a good source the optimal amount required for profit maximization from abroad.

[6] Which effect dominates depends on the degree the target industry is already fulfilling the LCR (i.e. to what extent the LCR is binding for the target industry). For instance, if the current domestic content in inputs is 60% and the LCR is 50%, the policy will have no effect on the composition of foreign and domestically produced intermediate inputs (Stone, Messent and Flaig, 2015[8]). Furthermore, the economic outcomes depend on how sensitive the intermediate good production reacts to changes in its output price (i.e. demand elasticity of intermediate goods) and how sensitive final good production is to changes in intermediate good prices (i.e. demand elasticity of final goods) (Veloso, 2006[10]).

[7] The abolition of the Act would boost employment in the overall economy with a net gain of around 300 000 jobs whereof the target sectors would see a fall of around 60 000 jobs while sectors in the rest of the economy would record an increase in jobs of around 360 000.

[8] The agency introduced a specific Local Content Primer – a guideline for bidding companies to accurately calculate the local content percentages for each (sub)-item.

[9] Petrobas first discovered the pre-salt layers in Brazil's offshore Santos Basin in 2005, and further exploration in the Santos, Campos and Espirito Santos basins revealed additional potential for oil production (US Energy Information Administration, 2017[55]).

[10] In light of intensified competition in the global energy markets, an expected loss of the share of fossil fuels in the global energy mix by 2040 (where oil, gas, coal and non-fossil fuels each contribute by around 25%) and the rapid growth of renewable energy sources (providing around 14% of primary energy), the ANP expects a significant drop in the value of fossil fuels (ANP, 2018[17]).

[11] The 15th (latest) bidding round took place in March 2018 on the basis of the new requirements.

[12] Petrobas held a monopoly position until 1997, when Brazil began liberalizing its energy sector by allowing international and domestic oil companies to operate in the market through concession agreements, authorizations or production-sharing-contracts (PSCs).

[13] For oil and gas exploration, the ship type "floating production storage and offloading units" (FPSOs) is primarily ordered.

[14] However, this number refers to the vessel capacity required to exploit the offshore oil and gas reserves in general, and is not purely a result of the LCR reform. It is not clear how many vessels would have been ordered anyway for offshore services in the absence of the policy reform.

[15] In order to serve USD 1 billion in final demand for oil and gas production the industry itself needs to generate oil and gas used in its production. Hence, total output in the oil and gas sector is with USD 1.03 billion slightly higher than final demand with USD 1 billion.

[16] It is not clear how much additional oil production is purely the result of the LCR reform, and the extent of oil exploration in the absence of the policy reform.

[17] According to Brazil's national account table the average yearly wage in the other transport equipment sector (including shipbuilding) amounted to around USD 21 000 in 2015. With 95 000 new jobs, total wages will represent about USD 1.99 billion. Taking the saving rate of Brazilian households of 11.6% in the same year, the expected household consumption will make up around USD 1.7 billion.

[18] The Jones Act was temporarily suspended by President Trump on September 28 in an effort to support relief efforts in Puerto Rico. Similar suspensions of the Jones Act occurred in the wake of Hurricanes Harvey and Irma, as well as Sandy in 2012, and Hurricanes Katrina and Rita in 2005, to expedite the delivery of fuel.

[19] According to one interpretation of the law, pleasure boats owned by companies and used to entertain clients are also subject to the law.

[20] Yet, according to a study published by Congressional Research Service (a public policy research agency of the US Congress) the US Department of Defence (DOD) frequently leases foreign vessels for missions that require sealift. The study reports that the DOD opposed the idea proposed by the American Shipbuilding Association (ASA) to reduce a legal limit on leases of foreign built-ships from five to two years, arguing that the "ship leases are the most cost-effective way to meet the needs for the ships in question." (O'Rourke, 2010[47]).

[21] See Hufbauer and Elliott (1993[49]); US International Trade Commission (1999[50]); Federal Reserve Bank of New York (2014[51]); Swisher and Wong (2015[52]); Krueger, Teja and Wolfe (2015[53]); Hansen (November 16, 2015[54]).

[22] Estimates calculated by Joseph Stiglitz during his time as chair of the Council of Economic Advisers under President Clinton.

[23] 60% are tugs < 2 000 GT, 10% are Anchor Handling Tugs and Supply (AHTS), 9% other offshore vessels, 6% miscellaneous ships < 2 000 GT and 2% dredgers.

[24] "According to oil shippers, the price for moving crude oil from the Gulf Coast to the U.S. Northeast on Jones Act tankers is $5 to $6 per barrel, while moving it to eastern Canada on foreign-flag tankers is 2.41 USD. " (Frittelli, 2014[28]).

[25] For more information on the measurement of value added in the shipbuilding industry see Gourdon and Steidl (forthcoming[12]).

[26] Increased firm productivity can also be reflected in lower prices if firms pass through their cost reductions to consumers.

[27] The US produces primarily low-value added ships, such as tugs, dredgers, some small offshore vessels and passenger ships, which can hardly explain an increase of production value as a

justification for the outstanding value added share of US output value. See Table A B.1 in Annex B for an overview of ships partly produced (i.e, work-in-progress) during 2016.

[28] Due to the lack of reported US newbuilt prices the simulation is based on research findings and observed transactions described in the previous section.

[29] As discussed in the previous section, the elevated operational costs were primarily a result of the higher living standards, wage rates and social benefits of the US crew required to operate the ship under the US Jones Act. In addition, the Jones Act imposes heavy restrictions highlighting the lack of flexibility for market participants and the elevated trade costs by using less efficient ships for transportation services. For instance, in the severe winter of 2014, New Jersey ran short of road salt. Enough road salt was available in Maine, only 400 miles away, close to vessel that could transport it. However, as a foreign vessel it was not Jones Act-compliant, and it was therefore banned from completing the delivery. Ultimately, the shipment was delayed and more than double what it would have cost had the foreign-vessel been able to transport it (Bergstresser and Melitz, 2017[16]).

[30] Note: this paragraph highlights the broader perspective which our simulation approach takes in comparison to Francois et al. (1996[11]) as discussed in the previous section.

[31] Please note, the simulation for the shipbuilding industry focuses only on commercial shipbuilding which is estimated to have an output value (not delivery value) of around USD 841 million in 2016. For more information on how the commercial ship production value for 2016 is derived see Annex C.

[32] Francois et al. (1996[11]) estimate welfare gains, materializing as a result of the removal of the, Act of USD 2 billion to USD 3.4 billion in 1989 USD annually, which corresponds to around USD 4 billion to USD 6.8 billion adjusted to 2018 USD annually (using USA consumer price indices from OECD Stat. (2019[56])). The results can be interpreted as the annual loss in real national income imposed by the Jones Act.