UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

La evolución del desarrollo industrial en los países en desarrollo: aplicación al caso del Norte de África. Un análisis del impacto de posibles acuerdos comerciales y de la industrialización verde

Jaime Moll de Alba Cabot

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TESIS DOCTORAL

La evolución del desarrollo industrial en los países en desarrollo: aplicación al caso del Norte de África. Un análisis del impacto de posibles acuerdos comerciales y de la industrialización verde de la región

Jaime Moll de Alba Cabot

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Programa de Doctorado Administración y Dirección de Empresas

Director: Dr. Francesc Solé Parellada

La presente tesis se realiza como compendio de publicaciones basado en un conjunto de tres artículos de investigación previamente publicados o aceptados para publicar de acuerdo a los artículos 12, 13 y 14 del RD 99/2011, de 28 de enero, por el que se regulan las enseñanzas de doctorado; el artículo 10.2 de la Normativa académica de los estudios de doctorado de la UPC, y la Normativa específica para la presentación de tesis como compendio de publicaciones en el Programa de Doctorado de Administración y Dirección de Empresas. Las referencias de las publicaciones, que forman parte integral de una misma línea de investigación, así como sus indicadores de calidad se relacionan a continuación.

Artículo 1

Título: Industrial development in North Africa: a comparative analysis in the period 2004-2012. Aceptado para publicación el 19 de Mayo de 2017

Autor: Jaime Moll de Alba

Revista: International Journal of Business and Globalisation

SJR (2016): Impact Factor 0,18, Q3 Business, Management and Accounting. Coverage: 2011-ongoing. ISSN 17533627, 17533635. H Index: 8

Artículo 2

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Autores: Simon Mevel – Jaime Moll de Alba – Dr. Nassim Oulmane

Revista: Journal of Economic Integration

SJR (2016). Impact Factor 0,194, Q3 Economics, Econometrics and Finance, Coverage: 2013-ongoing. ISSN 1225651X, 19765525. H Index: 4.

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Artículo 3

Título: How green is manufacturing? Status and prospects of national green industrialization. The case of Morocco. Aceptado para publicación el 9 de Mayo de 2017

Autores: Jaime Moll de Alba – Dr. Valentin Todorov

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SJR (2016). Impact Factor 0,229, Q3 Business, Management and Accounting, Coverage: 2005-ongoing. ISSN 17408822, 17408830. H Index: 17.

Contribuciones intermedias

Además de los artículos presentados en esta tesis, la investigación llevada a cabo durante el proceso de elaboración ha aportado otros resultados que se detallan a continuación.

1.- Publicaciones relacionadas con la investigación

Moll de Alba, J. and Todorov, V. (XXXX) 'An international world ranking of national green manufacturing: the green industrial performance index', actualmente en revisión en *World Review of Science, Technology and Sustainable Development* SJR (2016): Impact Factor 0,199, Q3 Multidisciplinary. Coverage: 2007-ongoing. ISSN 17412242, 17412234. H Index: 9

Moll de Alba, J. and Stucki, V. (XXXX) 'Enhancing youth employability: A Public Private Development Partnership (PPDP) model to acquire industrial skills', actualmente en revisión en *International Journal of Economics and Business Research* SJR (2016): Impact Factor: 0,113 , Q4 Business, Management and Accounting; Economics, Econometrics and Finance. Coverage: 2015-ongoing. ISSN. H Index: 2

2.- Participación en congresos, conferencias y jornadas

Conferencia internacional. 13th International CIRCLE Conference en Nápoles. Presentación "Industrial development of North Africa: a comparative analysis for the period 2004-2012". Fechas 30, 31 de marzo y 1 de abril de 2016.

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La época en la que vivimos nos ofrece la posibilidad de ser testigos privilegiados de los cambios constantes y acelerados en la forma de vivir, relacionarnos, producir y consumir de nuestra sociedad. La industria manufacturera constituye un ejemplo de particular relevancia que ilustra dichos cambios.

Los cambios que observo a mi alrededor me han convencido de la necesidad de cultivar al máximo mi formación personal. La realización de esta tesis doctoral resume mi experiencia vital tanto académica como profesional de los últimos 30 años. La presentación de dicha experiencia hoy constituye sólo el comienzo de una etapa fundamental de mi formación como persona y como investigador.

Más allá del documento en que queda plasmada, una tesis doctoral constituye un trabajo original de investigación, una construcción conceptual de gran valor personal. De hecho, la realización de una tesis doctoral transforma al doctorando en su forma de aproximarse, observar y analizar la realidad que le rodea al equiparle con las herramientas y métodos necesarios para afrontar el análisis y la comprensión de fenómenos complejos y permite además contribuir al conocimiento existente acerca de los mismos.

Mi decisión de estudiar Ingeniería Industrial constituye tal vez la prueba inicial de mi interés personal en la importancia de la industria manufacturera, la tecnología y la innovación para el desarrollo humano. La selección de la especialidad de Organización Industrial marca un punto de inflexión en mi futuro. Del mismo modo, la exposición a los conceptos básicos de la Teoría Económica por parte del Profesor Pere Escorsa en la Facultad Superior de Ingenieros Industriales de Terrasa despertaron mi interés en la relación entre las disciplinas ingenieriles y económicas. La influencia del Profesor Pere

Escorsa y del grupo de investigación de la Universitat Politècnica de Catalunya, que comprendía entre otros a los distinguidos Profesores Francesc Solé Parellada y Jaume Valls Pasola en el ámbito industrial marcó definitivamente mi futuro tanto académico como profesional. Mi proyecto de fin de carrera dirigido por el Profesor Escorsa Castells y que tenía como título "Ventajas competitivas y especialización de la industria española" da buena fe de ello. Ese trabajo constituyó mi primer contacto con las revistas científicas al quedar plasmado en el artículo "Especialización de la industria española en el período 1988-1994: Tendencias y oportunidades futuras" publicado en 1995 por el Boletín de Estudios Económicos. Dicho trabajo y mi colaboración con el Departamento de Administración de Empresas de la UPC desembocó en mi primera experiencia internacional, en la que en virtud del marco de cooperación entre la UPC y la Comisión Europea tuve el privilegio de ser seleccionado para trabajar representando a la UPC en Luxemburgo en el marco del *European Innovation Monitoring System*, centro de estudios en las áreas de innovación y transferencia de tecnología. Tengo que agradecer el papel pionero desarrollado por el Profesor Jaume Valls Pasola en su etapa en la Unidad de Prospectiva Científica (STOA) del Parlamento Europeo. Mi experiencia comunitaria en el ámbito de la investigación se prolongó durante diez años en los que trabajé con equipos europeos de investigación punteros.

En 2004, mi actividad profesional dio un giro importante al llevarme a trabajar al Departamento de Investigación Económica y Estadísticas de la Organización de Naciones Unidas para el Desarrollo Industrial (ONUDI). Dicho cambio marcaría definitivamente mi interés personal y académico por el papel que la industria manufacturera juega en la transformación estructural de las economías en vías de desarrollo. Desde entonces, he sido testigo tanto de dicho papel, como de las barreras a

las que se enfrentan los países, lo que me llevó a orientar mi actividad investigadora. Mis múltiples viajes, así como mi experiencia profesional como Representante de la ONUDI en Marruecos durante el período de 2013 a 2016 constituyen el elemento definitivo que me llevó a centrar esta tesis doctoral en la problemática del desarrollo industrial en la región del Norte de África.

En este largo, larguísimo periplo, el Profesor Francesc Solé Parellada ha jugado un papel primordial. Sus consejos y paciencia, así como los desafíos intelectuales que me ha ido planteando han resultado en la culminación de esta tesis doctoral. Muchas gracias, Profesor Solé Parellada, por su ayuda y supervisión.

Me permito asimismo agradecer el apoyo del personal administrativo y académico del Programa de Doctorado de Administración de Empresas de la UPC.

Finalmente, me gustaría agradecer el sostén y la comprensión de mi familia. A mis padres e hijos, por su continuo ánimo y motivación. A mi hermano Jordi, por su ejemplo y apoyo constante. A Marta, que me ha enseñado el significado de la palabra amor.

Esta tesis doctoral me ha cambiado tanto como persona como profesional. Por ello, agradezco finalmente a la Universitat Politècnica de Catalunya la oportunidad que me ha brindado y a todos los que desde ella me han ayudado a completar esta experiencia vital.

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RESUMEN

La evolución del desarrollo industrial en los países en desarrollo: aplicación al caso del Norte de África. Un análisis del impacto de posibles acuerdos comerciales y de la industrialización verde de la región

En la última década la importancia del desarrollo industrial como motor del crecimiento económico de los países ha recibido una atención renovada de la comunidad internacional. Los procesos de industrialización ofrecen respuestas a la ralentización del crecimiento económico, reducción de la pobreza, creación de empleo y estabilidad en el mundo. La región del Norte de África es objeto de un seguimiento particular, tanto por los cambios políticos y sociales que ha experimentado en la última década, como por los retos de desarrollo a los que se enfrenta.

Esta tesis doctoral analiza el estado, la evolución y la existencia de patrones diferenciados de desarrollo industrial en la región del Norte de África, así como el efecto de los acuerdos comerciales regionales y el papel de la industria verde en dicho desarrollo.

La presente tesis doctoral se realiza en la modalidad de compendio de publicaciones y el documento resultado de la misma está dividido en los siguientes apartados. El primer apartado introduce la investigación y los objetivos. El segundo apartado corresponde a los artículos de investigación que conforman la parte fundamental de la tesis. En el primer artículo “Industrial development in North Africa: a comparative analysis in the period 2004-2012”, se analiza el estado y la evolución del desarrollo industrial en la

región en términos de producción y comercio industrial. Como resultado más relevante, cabe destacar la existencia de dos "patrones de desarrollo industrial" basados respectivamente en la riqueza en recursos naturales y en la existencia de una base industrial significativa.

En el segundo artículo, “Optimal Regional Trade-Integration Schemes in North Africa: Toward a Pro-Industrialization Policy”, se analiza el impacto de varios acuerdos comerciales de la región del Norte de África. Dicho artículo remarca las diferencias significativas que diferentes acuerdos comerciales tienen en la promoción del comercio de productos manufacturados, y el efecto positivo de las medidas de facilitación del comercio.

El último artículo, “How green is manufacturing? Status and prospects of national green industrialization. The case of Morocco”, introduce un nuevo método para medir la industria verde, un área en la que no se han desarrollado con anterioridad metodologías de medición. El análisis del caso de Marruecos confirma que la simple existencia de políticas de promoción de una industria verde no se traduce necesariamente en el desarrollo de dicha industria.

El apartado final de esta tesis doctoral introduce los resultados de cada uno de los artículos de investigación, las conclusiones generales que se derivan, las limitaciones y las eventuales líneas de investigación futura.

Para la elaboración de la tesis doctoral se han utilizado datos de diferentes organismos internacionales. Metodológicamente, se utilizan diversas técnicas, que incluyen, entre otras, la identificación, cálculo e interpretación de indicadores clave de producción y comercio industrial; la modelización para evaluar el impacto de acuerdos comerciales sobre la industrialización y la computación de indicadores para medir la industria verde.

Cada artículo construye bases de datos sustentadas exclusivamente en las fuentes de datos de referencia.

Entre las principales conclusiones de esta tesis doctoral cabe destacar que el desarrollo industrial de la región del Norte de África no ha experimentado cambios significativos en el período 2004-2012, y se propone una metodología innovadora para medir la industria verde.

Entre las implicaciones destacan la ausencia de un modelo analítico integrado que permita realizar un estudio del desarrollo industrial de los países en vías de desarrollo y de la importancia de la industria verde para el desarrollo de los países.

Palabras clave: desarrollo industrial; cambio estructural; acuerdos de comercio; industria verde; desarrollo sostenible; Norte de África.

ABSTRACT

The progress of industrial development in developing countries: the case of North Africa. An analysis of the impact of potential trade agreements and green industrialization of the region

The last decade has witnessed a renewed interest of the international community in industrial development as an engine of national economic growth. Industrialization offers responses to sluggish economic growth, poverty reduction, job creation and stability in the world. The North African region is closely observed both for the social and political changes it has undergone during the last decade and the development challenges it faces.

This doctoral dissertation analyses the status and progress of industrial development as well as the existence of distinct patterns within the region of North Africa. It also analyses the impact of regional trade agreements and the role of green industry in its industrial development.

This doctoral dissertation is submitted as a compendium of research articles. The results are presented in this document that is organized in the following sections. The first section introduces the research and objectives. The second section presents the research articles that constitute the backbone of this dissertation. The first article “Industrial development in North Africa: a comparative analysis in the period 2004-2012” analyses the status and progress of industrial development in the region in terms of industrial production and trade. The main result is the existence of two patterns of industrial

development. One based on the wealth in natural resources and the other one on the existence of a significant industrial base.

The second article "Optimal Regional Trade-Integration Schemes in North Africa: Toward a Pro-Industrialization Policy" analyses the impact of several trade agreements of the North African region. The article underlines the significant differences of different trade agreements on the commerce of manufactured products as well as the positive effect of trade facilitation measures.

The last article "How green is manufacturing? Status and prospects of national green industrialization. The case of Morocco" introduces a new method to measure green industry. The latter constitutes a domain where no measurement methodologies have been developed in the past. The analysis of the case of Morocco confirms that the mere existence of green industry policies does not result in the development of that kind of industry.

The last section of this doctoral dissertation introduces the results of every research article, the general conclusions drawn, the limitations and the potential future research lines.

The doctoral dissertation has been elaborated using data from different international organizations. From a methodological point of view, several techniques including, among others, the identification, calculation and interpretation of key indicators of industrial production and trade as well as the use of modelling to assess the impact of regional trade agreements on industrial development and computation techniques to measure green industry are used. Each article has constructed databases which build exclusively upon leading data sources.

Among the main conclusions of this doctoral dissertation one could cite that the region of North Africa has not undergone significant changes in terms of industrial development during the period 2004-2012 as well as the proposal of an innovative methodology to measure green industry.

Among the worth mentioning implications, one can cite the lack of an integrated analytical model to undertake studies of the industrial development of developing countries as well as of the green industry importance for the development of countries.

Key words: industrial development; structural change; trade agreements; green industry; sustainable development: North Africa.

INTRODUCCIÓN

LA EVOLUCIÓN DEL DESARROLLO INDUSTRIAL EN LOS PAÍSES EN DESARROLLO: APLICACIÓN AL CASO DEL NORTE DE ÁFRICA. UN ANÁLISIS DEL IMPACTO DE POSIBLES ACUERDOS COMERCIALES Y DE LA INDUSTRIALIZACIÓN VERDE DE LA REGIÓN

Introducción

La industria manufacturera ha jugado un papel fundamental en el crecimiento económico y el desarrollo, tanto de los países avanzados, como de algunos países en vías de desarrollo. En las últimas décadas, gracias a la industrialización, determinados países experimentaron un crecimiento económico significativo mediante la trasformación de sus economías (Szirmai, Naudé y Alcorta, 2013, Haraguchi 2015, y UNIDO 2013, 2016 y 2017a). Consecuentemente, la industria manufacturera constituye un ejemplo de particular relevancia en el análisis de la transformación de las economías nacionales operada por los países, tanto por su capacidad, como por su velocidad de transformación.

Un recorrido rápido de la historia y evolución industrial permite distinguir cuatro procesos disruptivos o revoluciones industriales diferenciadas. La primera tiene lugar en el Reino Unido en los siglos XVIII y XIX mediante la utilización de la máquina de vapor como base de la producción mecánica. La segunda se produce en el siglo XX y se caracteriza por la división del trabajo y la producción en masa. La tercera se basa en la utilización de la electrónica y de las tecnologías de la información para así automatizar los procesos productivos en los años 70 del siglo XX. La cuarta y última se produce en el siglo XXI y en ella, según Schwab (2017) las tecnologías existentes y nuevas facilitan la fusión de los ámbitos físicos, digitales y biológicos. En dicha revolución industrial se abren grandes oportunidades a la vez que enormes interrogantes acerca del futuro, no sólo del desarrollo económico, sino de la humanidad en general.

La Cumbre de Río en el año 1992 sienta las bases del desarrollo sostenible (UNGA, 1992). Con el paso del tiempo se acentúa la necesidad de conciliar las esferas de desarrollo económico, social y medioambiental (UNGA, 2015) especialmente en los países en vías de desarrollo. Otro elemento relevante a tener en cuenta y al que se

enfrentan los países en desarrollo es una realidad cada vez más compleja, en la que las recetas tradicionales de transformación de sus economías mediante el desarrollo industrial no se adaptan a las reglas del comercio internacional, la propiedad intelectual y los acuerdos internacionales medioambientales, y en la que la producción y el comercio de productos manufactureros están concentrados en una serie de cadenas de valor localizadas en países que imponen unas barreras significativas de entrada en términos de conocimiento, capacitación y tecnología.

Tradicionalmente se ha considerado la transformación estructural de los países como el factor fundamental que explica el crecimiento económico y que se traduce en los cambios desde aquellos sectores de menor productividad de la economía, a aquéllos que disfrutan de productividad más elevada (Lewis 1954 y Kuznets 1966). A menudo, dicha transformación estructural se ilustra con los cambios que se han producido del sector de la agricultura a los sectores de la industria o los servicios.

El análisis comparativo de las economías a diferentes niveles de ingresos comprende numerosos estudios de investigación que incluyen, entre otros, un análisis del papel que la industria juega en el desarrollo las economías. Con el objetivo de centrar el marco conceptual de esta tesis se destacan los trabajos de investigación germinales de Clark (1940) que realiza un análisis de los cambios en la utilización del trabajo cuando aumentan los ingresos; Kaldor (1966, 1967, 1981) que incide en los retornos crecientes que caracterizan el sector industrial y que explican el proceso de desarrollo y de crecimiento económico; Kuznets (1956, 1966, 1971) que utiliza los datos de las cuentas nacionales para analizar cómo varían los componentes del producto interior bruto en distintos países, subrayando la necesidad de que se produzca un cambio estructural para que ocurra el crecimiento económico de un país.

A su vez, otros estudios analizan los cambios estructurales que se producen en los países al desarrollarse y describen los cambios en la composición de las economías con particular relevancia en los cambios desde la agricultura a la industria (Chenery 1960, Chenery y Taylor 1968, Chenery y Syrquin 1975 y Chenery, Robinson y Syrquin 1986).

Por lo que se refiere a esta tesis, se constata un interés particular en analizar el fenómeno de la desindustrialización como la reducción de la contribución del sector industrial al empleo de un país (Ramaswamy y Norton 1997, Saeger 1997 y Palma 2005, 2008 y 2014). Un caso de particular interés para los países en vías de desarrollo lo constituye la desindustrialización prematura. Dicha desindustrialización puede limitar el crecimiento de los países al no haber explotado el potencial que ofrece el sector industrial en su totalidad y el potencial que ofrece el sector servicios como motor alternativo de crecimiento (Tregenna 2015). Determinados autores como Rodrik (2015 y 2016) utilizan el concepto de desindustrialización prematura para cuestionar la pérdida relativa de importancia del sector industrial para inducir y liderar el crecimiento económico de los países. Por su parte Dasgupta y Singh (2005) sugieren dos tipos de desindustrialización en los países en desarrollo que resultan en un aumento del sector industrial informal y en una especialización focalizada en las ventajas comparativas nacionales actuales respectivamente.

Otra cuestión fundamental, que ha sido abordada por múltiples investigadores, consiste en analizar la relevancia actual y futura del sector industrial para el futuro crecimiento económico de los países. Así McMillan y Harttgen (2014) documentan un proceso de cambio estructural acontecido en África en el período 2000-2010. Ese cambio estructural coincide con un crecimiento relativamente elevado de sus economías en línea con lo documentado por McMillan et al. (2014) para el período 2000-2005.

Haraguchi et al. (2017) confirman en su trabajo la relevancia actual del sector industrial para el crecimiento económico como lo prueba su análisis que abarca los períodos 1970-1990 y 1990-2013.

Por otro lado, resulta importante tener en cuenta aquellos trabajos en los que se destaca el papel de las políticas de apoyo al desarrollo industrial. Esta línea ha sido muy rebatida e incluso ampliamente cuestionada por otros académicos. En esta línea se enmarcan la emergencia reciente de las estrategias y políticas de desarrollo industrial (Rodrik 2004, 2008a y 2014, Hausmann, Rodrik y Sabel 2008, Cimoli et al. 2009, Aghion, Boulanger y Cohen 2011, Aiginger 2012 y Stiglitz 2017), tanto en países desarrollados, como aquéllos en desarrollo, lo que Rodrik (2008b) describe como un proceso de normalización de la política industrial. Mientras que Lall (2004) indica que las estrategias industriales deben responder a las condiciones y objetivos específicos de cada país, para Rodrik (2004) la formulación de políticas industriales se sustenta mediante la articulación de un diálogo entre el sector privado y el gobierno. Igualmente UNECA (2014) recalca la importancia de establecer instituciones, mecanismos y procesos dinámicos que aseguren el diálogo sistemático entre los distintos actores incluyendo el sector privado, Andreoni (2016) identifica distintos patrones y prácticas en el área de política industrial y UNIDO (2016) subraya la importancia de establecer sinergias entre las políticas industriales y otras políticas. Algo semejante ocurre con Stiglizt (2017) que sugiere políticas industriales impulsadas por la demanda con objeto de mejorar la diversificación industrial y AfDB/OECD/UNDP (2017) que subraya el interés de desarrollar estrategias de industrialización verde. Finalmente, Rodrik (2014) propone utilizar la política industrial como instrumento de promoción de un crecimiento verde. Es decir, la comunidad internacional reconoce de forma recurrente la importancia

del desarrollo industrial como vector de crecimiento, como prueba el hecho de que la Agenda de desarrollo sostenible (UNGA 2015) adoptada en 2015 incluye un Objetivo de desarrollo sostenible (objetivo número 9) dedicado, por primera vez al desarrollo industrial inclusivo y sostenible, así como a la innovación y a la infraestructura.

En esta tesis doctoral se estudia la región del Norte de África. Esta región disfruta de una posición geográfica privilegiada que le ofrece un acceso prioritario al mercado de la Unión Europea, así como unos lazos únicos y muy sólidos con los países árabes. Esas relaciones convierten el Norte de África en un centro de gran potencial de desarrollo industrial. Como prueba de lo anterior el caso de Túnez, que es el país más industrializado de la región, muestra una contribución del sector industrial al producto interior bruto del 16,3 por ciento en el año 2016, mientras que un país del sudeste asiático como Tailandia, alcanza un porcentaje del 28,7 (UNIDO, 2017b). Además, la región engloba países con diferentes estados y trayectorias de desarrollo que ofrecen la posibilidad de analizar e ilustrar itinerarios diversos de dicho desarrollo. Dado que la región experimentó una serie de cambios sociales y políticos en la época objeto de análisis, el Norte de África es un caso excepcional que ilustra las aspiraciones de las sociedades para alcanzar un proceso democrático y libre de desarrollo con el impacto que eso conlleva en términos de formulación y puesta en marcha de las políticas públicas incluyendo aquéllas que tienen un impacto en la promoción del sector industrial. La región del Norte de África experimentó un crecimiento económico significativo del 3 % en 2016 (AfDB/OECD/UNDP, 2017) sustentado principalmente en el crecimiento de Egipto y Argelia.

En cuanto a la metodología utilizada en esta investigación, se han usado diferentes técnicas que responden de la forma más adecuada a los objetivos generales de la tesis y

a las preguntas de investigación planteadas. En el primer artículo se seleccionan una serie de indicadores clave con los que medir el estado y la evolución, tanto de la producción industrial, como del comercio de productos manufactureros. A partir de las bases del sistema estadístico de Naciones Unidas se calculan y analizan dichos indicadores compuestos. En el segundo, se utilizan técnicas de modelización para evaluar el impacto de los acuerdos de libre comercio regionales a partir de los datos de la base de datos del Global Trade Analysis Project (GTAP). Finalmente, en el tercer artículo para medir la industria verde se desarrolla una nueva metodología en base a los datos del sistema estadístico de Naciones Unidas y a la definición de productos verdes del Departamento de Comercio de EEUU, se computan y recodifican los productos en actividades industriales verdes, para a continuación medir la producción y el empleo industrial verde a nivel de país. Por lo tanto, esta tesis utiliza una combinación de técnicas que reflejan el estado del conocimiento de los distintos ámbitos de investigación construyendo en cada caso bases de datos de períodos de tiempo y espacios geográficos comparables que permitan la realización de un análisis profundo de la situación y, lo que es más importante, la derivación de conclusiones sustentadas en dichos datos.

Esta tesis doctoral parte de las siguientes afirmaciones del ámbito de desarrollo industrial:

- la evolución del desarrollo industrial en la región del Norte de África en el período 2004-2012,
- la existencia de patrones diferenciados de desarrollo industrial,
- el impacto de posibles acuerdos de libre comercio sobre el desarrollo industrial de la región,

- el papel dinamizador de la industria verde en la promoción del sector industrial a nivel de país.

Otro elemento clave de esta tesis lo constituye la robustez y la relevancia de las fuentes y metodologías que éstas utilizan para producir los datos utilizados. La investigación de esta tesis se basa exclusivamente en datos comparables obtenidos de distintas fuentes de datos de organismos internacionales. Un ejemplo es la base de datos de producción industrial de la Organización de Naciones Unidas para el Desarrollo Industrial (ONUDI) constituye, la denominada UNIDO INDSTAT, que a nivel de desagregación de dos dígitos almacena series de datos sobre el sector industrial para 170 países a partir del año 1963, utiliza una única clasificación de los datos para un período de más de 40 años, lo que la convierte en una herramienta singular para realizar análisis de cambio estructural. Los datos se estructuran en base a la Clasificación Industrial Uniforme (*International Standard Industrial Classification of All Economic Activities* en inglés) en la revisión 3 que abarca 23 industrias y contiene ocho indicadores industriales. Igualmente, la base de datos sobre el valor agregado manufacturero de la ONUDI constituye otra fuente utilizada de forma recurrente en esta tesis. Dicha base datos presenta datos a nivel de país sobre el producto interior bruto, el valor agregado manufacturero y la población desde el año 1990.

Para terminar este apartado introductorio, valdría la pena destacar el creciente interés generado acerca del papel dinamizador del sector industrial, independientemente del estado de desarrollo de los países. En general, esa dinamización debería garantizar un crecimiento económico más inclusivo y más sostenible y por tanto verde.

Objetivos de la tesis

Los objetivos de esta tesis doctoral que se presenta como un compendio de artículos de investigación se detallan a continuación. Primero se introducen los objetivos generales de la tesis doctoral, para acto seguido detallar los objetivos específicos de cada uno de los tres artículos de investigación que conforman el compendio de esta tesis.

La tesis doctoral "La evolución del desarrollo industrial en los países en desarrollo: aplicación al caso del Norte de África. Un análisis del impacto de posibles acuerdos comerciales y de la industrialización verde de la región" comprende los siguientes objetivos generales:

- Analizar el estado y evolución del desarrollo industrial en la región del Norte de África y los posibles patrones de dicho desarrollo en la región.
- Medir el impacto de posibles acuerdos comerciales en términos de industrialización de la región.
- Explorar el potencial de la industria verde como motor de expansión de la industrialización de la región.

La tesis doctoral en su conjunto, así como los artículos de investigación que la conforman contribuyen a una misma línea de investigación que se centra en la evolución del desarrollo industrial en la zona del Norte de África y el papel potencial que los acuerdos comerciales y la industria verde pueden jugar en el proceso de industrialización de la región.

La principal contribución de esta tesis consiste en realizar el análisis de la evolución del desarrollo industrial en países en desarrollo a nivel regional en el período de referencia. Se analiza la evolución del desarrollo industrial en la región seleccionada y su papel en la economía de la región. Al mismo tiempo, se identifican distintos "patrones de

desarrollo industrial" en el seno de la región. A continuación se analizan dos aspectos que se consideran de particular relevancia para acelerar el futuro desarrollo industrial de la región objeto de estudio. En primer lugar, se mide el impacto de posibles acuerdos comerciales regionales en la actividad industrial de la región seleccionada. En segundo lugar, se analiza el posible rol que podría jugar la industria verde en la región seleccionada como vector dinamizador de su desarrollo industrial y al mismo tiempo responder a las aspiraciones de un crecimiento económico sostenible. Todo ello contribuye a enriquecer el estado del arte general de la economía del desarrollo económico.

Una vez acordados los objetivos generales de la tesis y su contribución esperada, se pasó a definir los tres artículos de investigación. En el primer artículo se lleva a cabo un análisis comparativo de la estructura de producción y comercio de manufacturas en la región y período de referencia. El segundo artículo se focaliza en analizar el papel que la integración comercial regional por medio de acuerdos de libre comercio puede jugar en la re-industrialización de la región seleccionada. Finalmente, el tercer artículo aborda el análisis de la importancia y el papel de la industria verde como vector de desarrollo del sector industrial.

Los objetivos específicos de cada uno de los tres artículos de la tesis se relacionan a continuación.

En el artículo “Industrial development in North Africa: a comparative analysis in the period 2004-2012” se analiza la evolución del desarrollo industrial de la región del Norte de África. El objetivo de dicho artículo era analizar si la región se ha transformado estructuralmente durante el período 2004-2012, en el que el continente africano ha experimentado un crecimiento económico significativo, así como identificar

la posible existencia de distintos "patrones de desarrollo industrial" en el seno de la región.

En el artículo “Optimal Regional Trade-Integration Schemes in North Africa: Toward a Pro-Industrialization Policy” se analiza el papel que la integración comercial regional por medio de diferentes acuerdos de libre comercio puede jugar en la re-industrialización de la región del Norte de África.

El artículo “How green is manufacturing? Status and prospects of national green industrialization. The case of Morocco” sirve para desarrollar y probar una metodología de análisis de la industria verde en términos de producción y empleo industrial y así analizar el papel desempeñado por la industria verde y el potencial que ofrece para dinamizar el desarrollo industrial de Marruecos, uno de los países de la región del Norte de África que se ha dotado activamente de una política que busca incentivar el desarrollo de la industria verde.

ARTÍCULO 1: INDUSTRIAL DEVELOPMENT IN NORTH AFRICA: A COMPARATIVE ANALYSIS FOR THE PERIOD 2004–2012

Industrial development in North Africa: a comparative analysis for the period 2004–2012

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Abstract

This article examines the status of industrial development in North Africa during the period 2004–2012. The objective is to find out whether, during a period of relatively significant economic growth of the African continent followed by a global crisis, the industrial sector of the North African region has experienced significant changes which have underpinned its growth. We carry out a comparative analysis with other selected developing regions, based on a set of key indicators relating to the industrial production and trade of manufactured products using internationally comparable datasets for the reference period. Our analysis indicates that the manufacturing base of the region remains weak. Our study contributes to understand the status and the patterns of structural transformation of the North African region and proposes recommendations.

Keywords: industrial development; structural change; manufacturing; trade of manufactures; North Africa.

1 Introduction

The globalisation process of industrial development and trade results in an uneven development in different countries and regions. In that regard, two significant trends seem to have emerged in recent years: namely technological development, resulting in labour saving, and a significant reduction in transaction costs and transport (Rodrik, 2015).

In today's globalised world, multiple studies analyse industrial development within the framework of international competitiveness, considering the role of such factors as institutions, infrastructure, health, education, financial markets, technology and innovation (Dagdeviren and Mahran, 2010). North African countries are heterogeneous in terms of population, resources and capital endowments. Algeria and Libya are rich in certain natural resources, namely natural gas and oil. Egypt and Morocco display the two largest industrial bases in the region, while Tunisia has traditionally shown the greatest industrial intensity. The region includes one least developed country (LDC), namely Sudan, and in its recent past it has undergone significant social and political changes, which have, in turn, also affected its economic performance.

The existence of different national institutions and policies followed by countries might have had a significant impact on their industrial development. For instance, Lall (2004) underlines the need to tailor industrial policies to the specific conditions of the target countries, and Harrison et al. (2014) suggest that different policies have distinct implications for structural change. Bigsten et al. (2003) stress the companies' lack of access to credit. Yumkella and Vinanchiarachi (2003) highlight the shortcomings in terms of infrastructure as barriers limiting industrial development while Harrison et al. (2014) consider that the development of telecommunications and other tertiary services has fostered the emergence of industries.

Structural change drives economic growth by operating shifts from lower to higher productivity sectors; mainly from agriculture, to industry and services. Manufacturing thus offers economies the possibility to sustain growth by moving to higher productivity sectors and constitutes a large creator of relative well-remunerated jobs that display higher productivity (UNIDO, 2013a; Weiss, 2011). Bigsten and Söderbom (2011) refer to the mitigated results of different types of industrial policy interventions in Africa

since 1960, while stressing that, if a good governance system is in place, there is ample room for supporting the emergence of the industrial sector in the continent.

This study examines the status of industrial development in North Africa during the period 2004–2012. Our research objective is to find out whether during a period of relatively significant economic growth of the African continent, followed by a global crisis from 2008 onwards and the Arab Spring in 2011, the industrial sector of the North African region experienced significant changes, and underpinned the economic growth of the region. We construct a comparable dataset using international data sources for the reference period to carry out a comparative analysis between the group of North African countries and selected comparators. We focus in particular on North African industrial production and technology structure as well as on manufacturing export intensity and structure.

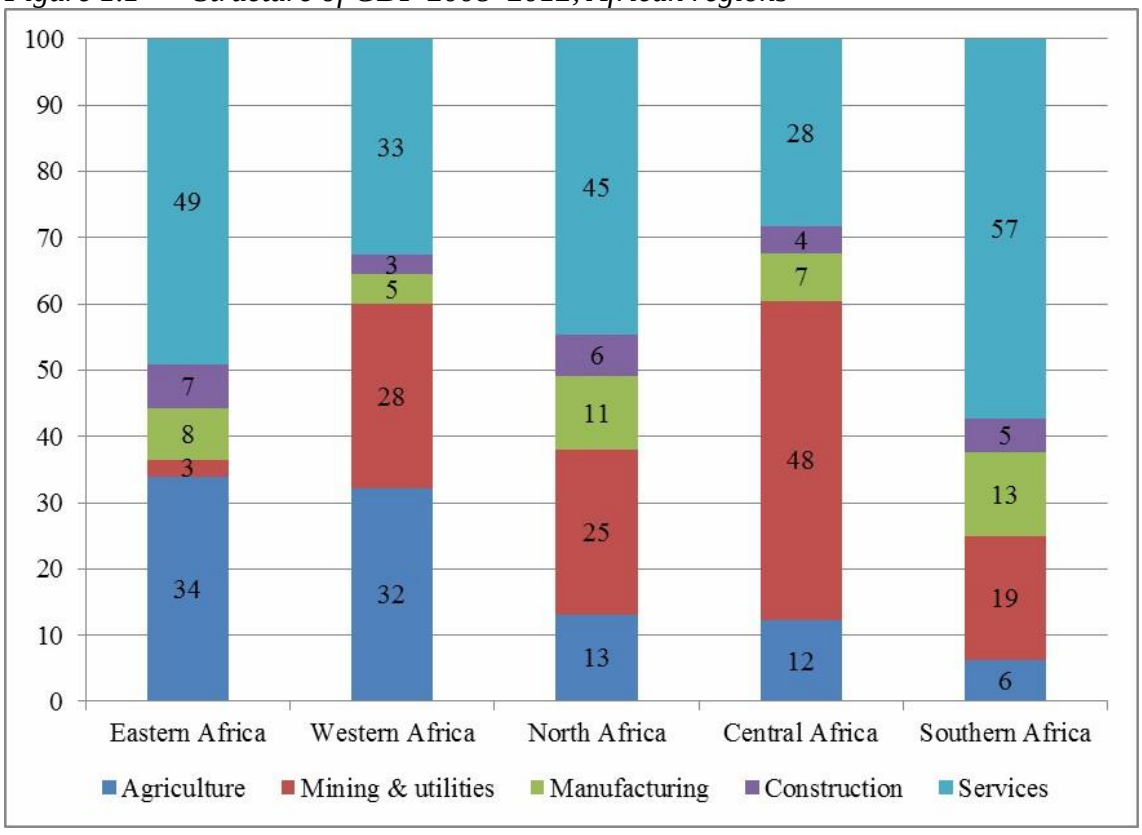
This paper is structured as follows: after this general introduction, Section 2 introduces the main trends experienced by the African continent in terms of growth during the reference period. Section 3 presents the methodology used to undertake our analysis. Section 4 discusses the status of the industrial development of the North African region by analysing both industrial production and the trade of manufactured products. Finally, Section 5 presents the conclusions and a set of recommendations.

2 Growth trends in Africa during the reference period

The comparatively significant African economic growth during the reference period of our study has been extensively documented. The African continent achieved in the past years comparatively significant growth rates 5% on average since 2000, except for 2009 due to the world financial crisis and 2011 due to the social and political changes related to the Arab Spring (AfDB et al., 2015). There are, however, different views on the

sustainability of such growth. Arbache et al. (2008) confirm the acceleration of growth in Sub-Saharan Africa (SSA) but warn that it is fragile due to the weakness of such economic fundamentals as productivity and investment. Moreover, Arbache and Page (2010) conclude that accelerations in the growth of the economies rich in minerals have played an important role in Africa's recent economic performance. Other authors (AfDB, 2014; Leke et al., 2010) argue that such growth has been, however, more than a simple commodity boom and refer, among others, to such factors as better macroeconomic management, increased domestic demand and higher social stability to explain such growth rates as well as favourable external conditions. Rodrik (2014) is cautious about the prospects for future, significant growth of Africa and indicates that structural change and industrialisation are taking place at a moderate pace in the continent.

Figure 1.1 Structure of GDP 2008–2012, African regions



Source: UNIDO

Such a significant economic growth has not been, unfortunately, accompanied by the significant structural transformation of the continent moving from low to high-level productivity activities. Africa continues to lag behind in terms of industrialisation (Page, 2011; Zamfir, 2016). Bigsten and Söderbom (2005) confirm that the manufacturing sector of Africa remains small and has failed to integrate into international production and trade networks. Several analyses stress that substantial structural change is yet to take place for the African continent to sustain its transformation with industrialisation playing a leading role (ACET, 2014; UNECA, 2014; Page, 2016). The development path followed by Africa has resulted in its deindustrialisation as proven by a declining share of manufacturing value added (MVA) in total value added from 13% in 1990 to 10% in 2011 (UNCTAD, 2014). This trend is also confirmed for the most recent years, even beyond our reference period. Thus, according to UNIDO (2016), Africa's share in the world's MVA is a meagre 1.6%, and its share of MVA in gross domestic product (GDP) remains as low as 10.1% in 2014.

While the contribution of the various economic sectors to GDP varies from one African region to one other, the share of manufacturing remains meagre (see Figure 1) in all.

North African countries already sought to diversify their economies already back in the '60s and '70s, using either import substitution policies or heavy industrialisation program, and continued doing so in the '80s and '90s during the structural adjustment policies period (Mevel et al., 2015). Upadhyaya and Yeganeh (2015) confirm the dismal contribution of North Africa to world's MVA and manufactured exports. Our analysis concludes that the manufacturing sector continues to play a minor role in the economies of the countries of the North African region (see Table 1).

Table 1.1 Population, GDP and MVA level and growth rate by region

	2012 value			*Average annual growth rate (in %) 2008–2012*		
Country group	*Population (in million)*	*GDP (in billion US$)*	*MVA (in billion US$)*	*Population*	*GDP*	*MVA*
Central Africa	43	49	5	2.31	4.24	2.99
Eastern Africa	202	75	5	2.56	5.94	5.14
North Africa	207	448	47	1.62	2.04	1.51
Southern Africa	287	479	61	2.30	2.79	1.04
Western Africa	320	267	14	2.61	6.33	5.08
Africa	1,059	1,317	131	2.31	3.42	1.81
Developing countries	5,811	14,763	3,039	1.26	5.07	5.67

Source: UNIDO

3 Methodological approach

This analysis focuses on the six countries of the North Africa geographical sub-region, as defined by the United Nations Statistics Division, for which data were available for the reference period (2004–2012). Thus, our study covers Algeria, Egypt, Libya, Morocco, Tunisia and Sudan. Following its secession from Sudan, the Republic of South Sudan became a new member state of the United Nations General Assembly in July 2011. Due to the limited availability of data corresponding to South Sudan, it is not included in our analysis.

For each country/region and comparator country/region(s) included in our analysis, we use data available from 2004 to 2012, or the nearest available year. We use exclusively international comparable data sources, namely UNIDO MVA database and UNIDO industrial statistics database (INDSTAT 2), the United Nations Commodity Trade Statistics Database (UN Comtrade) from UNSD and World Bank world development indicators (WDI) data.

For the purposes of our analysis, we have made use of a core set of indicators for the industrial production and trade of manufactured products extracted from the set of sub-

indicators of UNIDO's competitive industrial performance (CIP) index (UNIDO, 2016). This article considers thus both the capacity of regions/countries to produce manufactured goods as well as their ability to do so in such a competitive manner it that allows them to trade those goods in the international markets (Lall, 2000; UNIDO, 2013a, 2016).

In our analysis, we do use the following indicators to assess the status and trends of industrial development of the North African region and their countries:

1 Industrial production indicators

1.1 MVA which constitutes a commonly accepted and used proxy to measure the level of industrialisation of a country.

1.2 MVA per capita that adjusts the MVA value for a given region/country's size.

1.3 To consider the complexity of production in a given country, we use the share of medium and high-tech (MHT) activities in MVA proposed in the UNIDO definition. The basic principle is that the higher the share, the higher is the complexity of a given region/country industrial structure. Moreover, more complex activities are considered in order to generate in higher values.

1.4 To assess the relative importance of manufacturing in an economy we use MVA as a share of GDP. The higher the share, the more a region/country has industrialised.

We use data from the UNIDO MVA database at 2005 constant US$, except for the MHT activities, whose data come from INDSTAT 2. Population data are extracted also from the UNIDO MVA database.

2 Manufactured goods trade indicators

2.1 Manufactured exports help us capture the ability of regions/countries to produce goods competitively, penetrate into international markets and trade with them. Similarly, as is the case with MVA, we have adjusted this indicator for a given region/country's population.

2.2 To analyse the complexity of exports, we use the share of MHT exports (as per UNIDO definition) in manufactured exports. The principle is the same; the higher the share, the higher the complexity of the exports from a given country.

2.3 We also look at the share of manufactured exports in total exports, which provides us with an indication of the role of manufacturing in trade and the complexity of a country's commerce.

All trade indicators are calculated using data from the UN Comtrade.

We analyse the values over the last five years of the reference period, and their progress, by calculating the annual average growth rates of two sub periods, namely 2004–2008 and 2008–2012. We compare the situation of North Africa to that of the other African regions as well as to those of developing countries as a whole. We also undertake a similar analysis at country level for the North African region to shed light on their similarities and differences.

In addition, we carry out an analysis to place the relative industrial performance of North Africa compared to other world regions in terms of both value and growth. We also analyse the concentration of exports in terms of markets and products using the Herffindal index (Nawrocki and Carter, 2010).

4 Industrial development in North Africa

In this section, we present the results of our analysis about the industrial production and trade of manufactured goods of North Africa for the period 2004–2012.

4.1 Industrial production

From 2008 to 2012, the share of Africa in world population increased from 14.4 to 15% growing faster than its share in world MVA, which stagnated at 1.48%. The share of Africa in developing countries' MVA, which increased their share in world's MVA, declined from 5% in 2008 to 4.3% in 2012. During the same period, the share of North Africa in world's population grew from 0.28 to 0.29%, whereas its share in world's

MVA stagnated at 0.53%. Developed countries with a combined population of 17% held more than 65% of global industrial production in 2012.

In line with the overall trend in the whole of Africa, the North African region displayed a significant slowdown of its already comparatively moderate average MVA growth rate from 4.66% during 2004–2008 to 1.51% in 2008–2012 (Table 2). This is worth comparing with Western Africa, which accounts only for 10.53% of African MVA, but managed to increase its MVA average annual growth rate from 3.05 to 5.08% during the same periods, or with Eastern Africa, which managed to remain at more than 5% annual average growth rate but accounted only for 3.96% of the African MVA. Despite the decline in developing countries their average annual growth rates remained at a comparatively higher level, i.e., 5.67% during the period 2008–2012.

Low and stagnant MVA levels explain the low level of MVA per capita in Africa, US$124 in 2012. This is more than four times less than developing countries. North Africa despite showing the highest MVA per capita among African regions in 2012 with US$274 records comparatively lower levels than those of other country groupings. Previous research by UNIDO indicates that Africa has not benefited from the increase in manufacturing production and exports recorded by developing countries since 2000 (UNIDO, 2009). Moreover, during the period 1990–2010 the Middle East and North Africa only managed to achieve a small increase in MVA per capita, with the exception of Turkey, with no sign of diversification, so the region remains dependent on oil (UNIDO, 2013b).

Table 1.2 Level and growth of MVA per capita by country group/country, US$ constant 2005

Country group	*2008*	*2009*	*2010*	*2011*	*2012*	*Average annual growth rate (in %)*	
						2004–2008	*2008–2012*
Central Africa	104	101	104	105	107	–0.09	0.68
Eastern Africa	23	24	25	25	26	3.04	2.24
North Africa	274	277	280	266	274	3.04	0.07
Southern Africa	224	203	209	212	213	3.07	–1.11
Western Africa	39	40	40	41	42	0.45	2.42
Africa	126	121	123	122	124	2.43	–0.47
Developing countries	444	448	480	506	525	6.76	4.31
Algeria	181	189	160	170	170	1.17	–1.15
Egypt	225	230	238	232	234	4.59	1.07
Libya	431	439	437	100	222	2.03	–12.37
Morocco	306	305	310	314	319	2.28	1.11
Sudan	61	61	68	64	62	2.38	0.59
Tunisia	565	540	596	597	616	2.76	2.32

Source: UNIDO

The situation in North Africa looks comparatively worse when one considers both its limited industrial fabric and its growing population. MVA per capita stagnated during 2008–2012 compared to a 3.04% growth in 2004–2008 (Table 2). Despite significantly lower levels of MVA per capita, Western Africa increased its MVA per capita by 2.42% during 2008–2012, to reach US$42 and Eastern Africa, despite a contraction, recorded an average annual growth rate of 2.24% recording US$26 in 2012. The stagnation of MVA per capita contrasts with an increase during the period 2008–2012 of almost US$81 in developing countries, reaching a value of US$525 in 2012. Despite showing the highest MVA per capita in African regions, not only does North Africa still lie far behind other world country groups but also the existing gap is increasing because of its stagnation in 2008–2012.

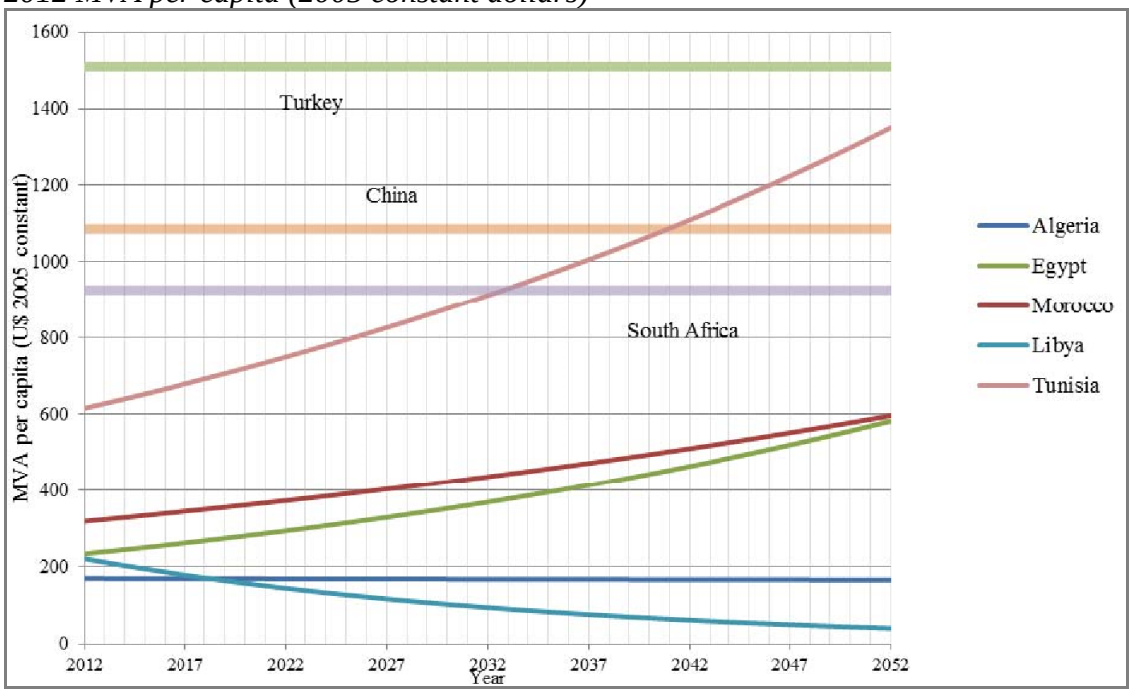
The aggregate growth rate of the North African region masks differences between countries. All countries in the region experienced lower average annual growth rates of

MVA during 2008–2012 compared to 2004–2008. Egypt, which accounted for more than 40% of the region's MVA in 2012, showed that its growth rate dropped from 6.50 to 2.84%, while Libya, which that accounts for barely 3% of the North African MVA, plummeted in the 2008–2012, when it recorded a rate of –12.11%.

Consequently, all countries of the region recorded significant declines in the growth rates of MVA per capita. Tunisia displayed the highest value in 2012 at US$616 almost ten times more than Sudan whose MVA per capita stagnated in 2008–2012 and almost twice that of Morocco (US$319), the second largest value in the region whose MVA per capita experienced a moderate growth (1.11%) during 2008–2012. Algeria (–1.15%) and Libya (–12.37%) experienced a decline in their MVA per capita in 2008–2012, with their respective values dropping to US$170 and US$222 in 2012, respectively.

Based on their average growth rates for 2003–2012, only one country in the region, namely Tunisia, will, in the coming 40 years, reach the MVA per capita levels already achieved by some selected countries, i.e., 21 years for South Africa and 29 years for China (Figure 2) but it will fail to catch up with others such as Turkey. At current growth rates, all other North African countries would fail to catch up with the current MVA per capita levels of other countries. In the coming years, North African countries should record significantly higher growth rates to close the gap with selected countries in terms of MVA per capita.

Figure 1.2 Catching-up of North African countries with selected countries based on 2012 MVA per capita (2005 constant dollars)



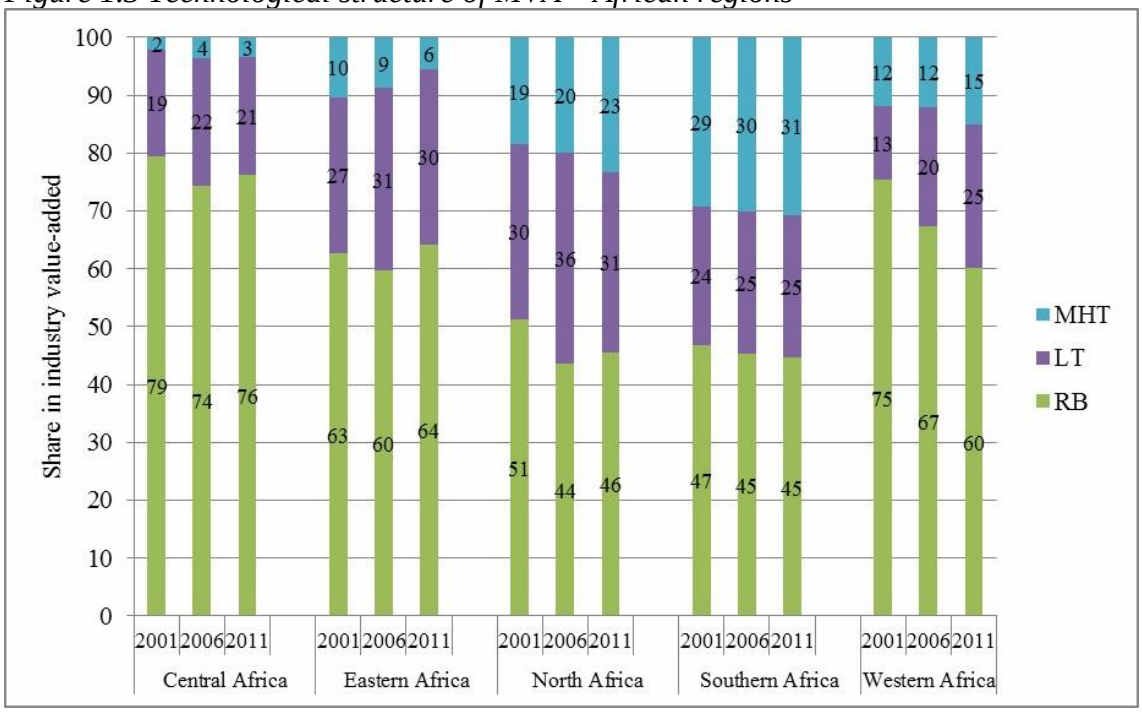
Source: Base don UNIDO data

The intra-industry structure of African regions' manufactured production is illustrated in Figure 3. It is worth noting that SSA has recorded a low rate of change in its industrial structure. Resource-based activities continue to dominate SSA industrial structure. SSA failed to follow the pace of the general shift to more complex industrial activities (UNIDO, 2013b). Moreover, in 1990–2010 SSA reduced its capacity to capture manufacturing value, as proven by the decline by one third of its share of MHT MVA in total manufacturing (UNIDO, 2013a).

Southern and North Africa, which accounted together for four-fifths of African MVA in 2012, showed also the highest share of MHT products in the region at 31 and 23%, respectively. MHT activities are beneficial as they grow faster especially in medium and high-income levels, offer enhanced learning opportunities and spill over effects (UNIDO, 2009). The share of resource-based activities accounted for almost half of MVA and remained significant in both Southern (45%) and North Africa (46%). Low-tech MVA plays in Africa a less significant role in manufacturing than that one could

expect bearing in mind its development stage and have recorded a decline associated with the decrease in textiles production (UNCTAD and UNIDO, 2011).

Figure 1.3 Technological structure of MVA – African regions



Source: UNIDO

During 2002–2011, the Middle East and North Africa followed, to lesser extent, the world trend to shift continuously over time towards more complex products. Thus, the share of resource-based manufacturing dropped (40.3%) while MHT activities increased (32.7%) (UNIDO, 2013a). Overall, despite moderate declines, the share of resource-based activities remains the largest component in all African regions. Central, Eastern and Western Africa, display also the highest share of resource-based activities, which accounted for 76.64 and 60%, respectively.

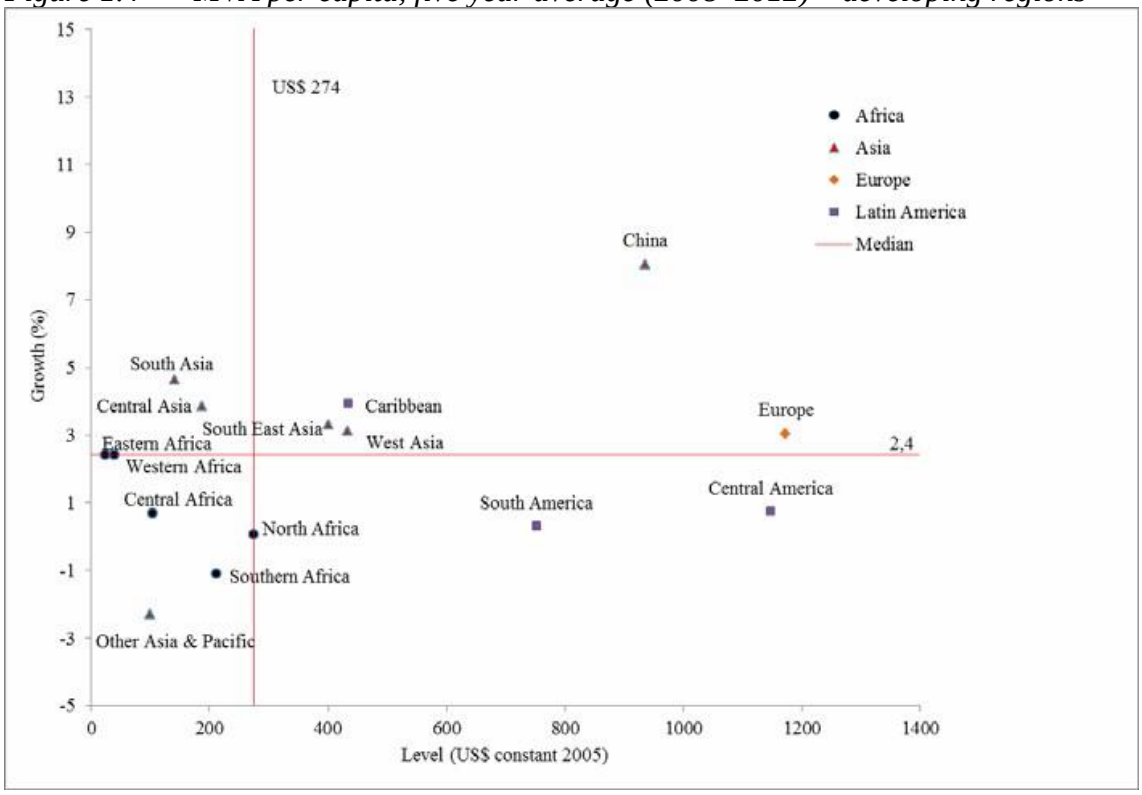
We also examine the relative industrial performance of North Africa compared to other selected world regions. Figure 4 presents the MVA per capita level of selected world regions with their MVA per capita growth. Using the MVA median growth (2.4%)

during 2008–2012 and the MVA per capita median level (US$274) in 2012 of selected regions, the graph can be divided into four zones to illustrate relative performance.

In the top-right quadrant, one finds such regions as Europe, South East Asia, the Caribbean and South America and countries such as China, which records an impressive 8.04% average growth rate, with comparatively higher MVA levels and growth rates. The bottom-right quadrant includes regions such as Central America and South America that have also achieved relatively higher levels of MVA per capita, but are experiencing difficulties in sustaining their growth. The top-left quadrant includes regions such as South Asia with a relatively lower manufacturing base but a significant level of growth with a 2008–2012 average MVA per capita growth rate of 4.64%. Finally, one finds regions with declining MVA per capita from already relatively low levels in the bottom-left quadrant. The latter concentrates the African regions, namely Central, Eastern, Western and Southern Africa.

North Africa shows relatively low average growth rates in MVA per capita combined with a value that falls exactly in the median of all regions. In general, the relative performance of African regions is weak; none of them recorded higher values than the median for the chosen variables.

Figure 1.4 MVA per capita, five year average (2008–2012) – developing regions



Source: Based on data from UNIDO

Africa industrial sector remains underdeveloped (Lall, 2005; Bigsten and Söderbom, 2011; UNIDO, 2009, 2013a, 2013b) moreover, Africa deindustrialised during 1992–2012 (Figure 6). Its level of industrialisation, using as a proxy the share of MVA in GDP, has declined from 11.63 in 1992 to 9.95 % in 2012. This accentuates the overall trend experienced in 1950–2005 when manufacturing industries followed an almost flat trajectory, reaching in 2005 a share of MVA in GDP of 11 % equivalent to that in 1950 (Szirmai, 2012; UNIDO, 2013b) The share of MVA in GDP has declined in all African regions to values ranging from 5.09% in Western Africa to 12.76 in Southern Africa (Table 3). In North Africa that share slightly declined to 10.41% in 2012. This compares to an increase in developing countries as a whole where MVA reached 20.59% of GDP in 2012.

An additional issue worth considering is the fact that, overall, Africa's manufacturing sector grew slower 1.81% than its economy as a whole 3.42% during 2008–2012. The

same applies to the previous period 2004–2008 despite higher growth rates 4.82 and 5.65%, respectively. Even the post-1995 growth of Africa was weak and the lack of industry in the continent constitutes a barrier to its growth prospects and makes it more difficult to attract industry compared to regions that have already industrialised (Page, 2011). Thus, despite some growth in SSA, the challenge to accelerate and sustain will remain a significant one in the years to come (Arbache et al., 2008).

Table 1.3 Share of MVA in GDP by region

Country/region	*1992*	*2002*	*2012*
Central Africa	9.91	10.81	9.40
Eastern Africa	8.46	7.49	6.95
North Africa	10.91	11.49	10.41
Southern Africa	15.01	14.66	12.76
Western Africa	7.16	6.42	5.09
Africa	11.63	11.56	9.95
Developing countries	16.49	18.68	20.59

Source: UNIDO

No African region recorded higher growth rates in its manufacturing sector than that of its economy as a whole either in 2004–2008 or during 2008–2012. The highest manufacturing and economic growth rates (higher than 4.85%) during 2008–2012 were recorded in Western and Eastern Africa. Both are among the least industrialised African regions and accounted in 2012 only for 10.68 and 3.8%, respectively of the African MVA. Unlike other developing regions, the economic growth experienced in the last decades by Africa has not resulted in significant structural change jeopardising the future sustained growth of the continent. The above trend has been exacerbated by the decline in growth rates during 2008–2012. The same applies to North Africa (see Figure 5) whose MVA grew slower than its GDP. This might be explained by the fast growing service sector in the close proximity of European market, and by the fact that the mining

sector constitutes the main component of industrial activity in a number of economies within this region.

4.2 Trade of manufactured goods

Africa continues to rely heavily on primary exports that account for 62% of its total exports in 2008–2012. Africa remains thus at the mercy of the volatility of world market prices of primary products, mainly raw material and natural resources. During the reference period, primary products grew comparatively fast, due to the strong demand from developing countries such as China and India.

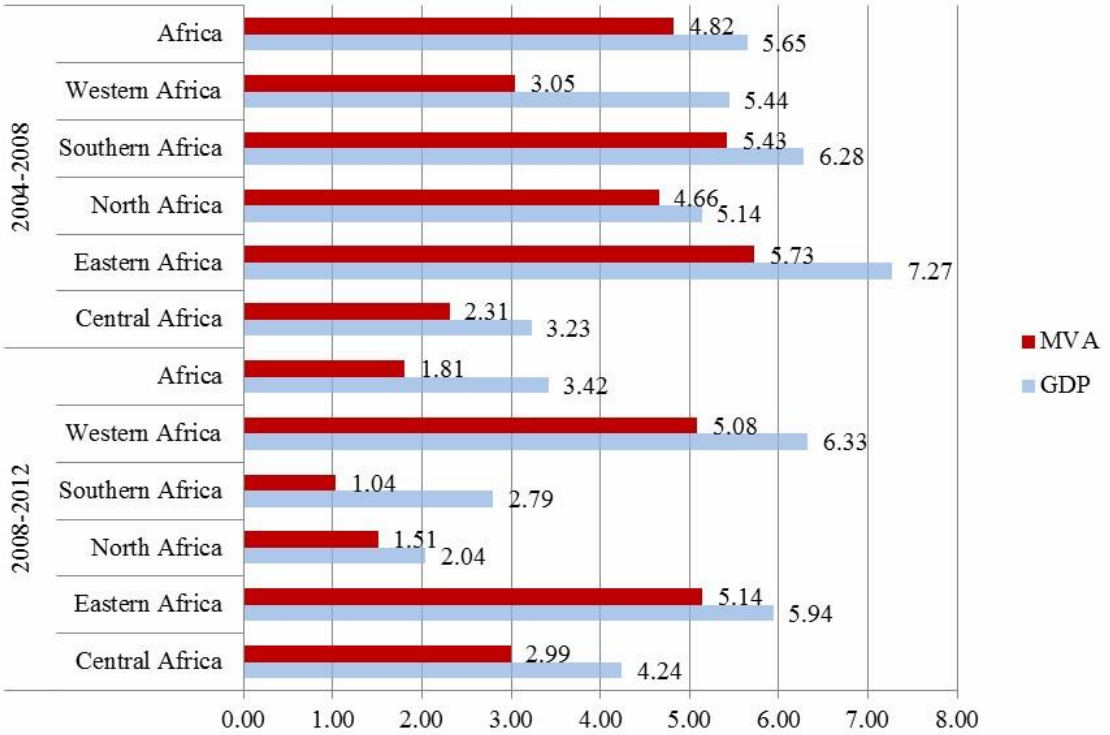
Only South Africa, the African region with the largest industrial base, records, at 66%, a higher share of manufactured exports than that of primary products at 34%. Despite its comparatively low industrial fabric, the share of manufactured exports in Eastern Africa, 44%, is higher than that of North Africa at 41%. Both Western Africa and Central Africa, which have a smaller industrial base, rely heavily on primary exports that account for more than four-fifths of their exports.

The structure of exports of North African countries shows two differentiated patterns. On the one hand, the resource rich countries, namely Algeria and Libya rely heavily on the export of natural gas and oil. Primary products in Libya and Algeria account for 84 and 78% respectively of their total exports. Both countries get the largest part of revenues from the exports of the above natural resources. On the other hand, the three North African countries, namely Egypt, Morocco and Tunisia, endowed with a much larger industrial base display a significantly larger share of their exports based on manufactured products at 63.78% and 83%, respectively.

With 60%, high-tech products dominate the exports of world manufactures. During 2000–2011 resource-based products increased their share in total manufacturing exports

thanks to the growth of manufacturing activities in developing countries that translated into higher demand for raw materials and processed food for their larger urban population (UNIDO, 2013a). In line with the traditional development path undergone in the past by industrialised economies, the most dynamic developing and industrial emerging economies increased their share MHT products in world exports by an average annual growth rate of 6.4% during 2005–2013 (UNIDO, 2016). Unfortunately, North African countries display a significantly different performance. Not only are African exports dominated by primary products, but less complex products also constitute the large majority of African manufactured exports. More than two thirds of African manufactured exports are resource-based (52%) and low-technology (18%) products. Only 30% of African manufactured exports are MHT products.

Figure 1.5 Growth of MVA and GDP (%) – African regions

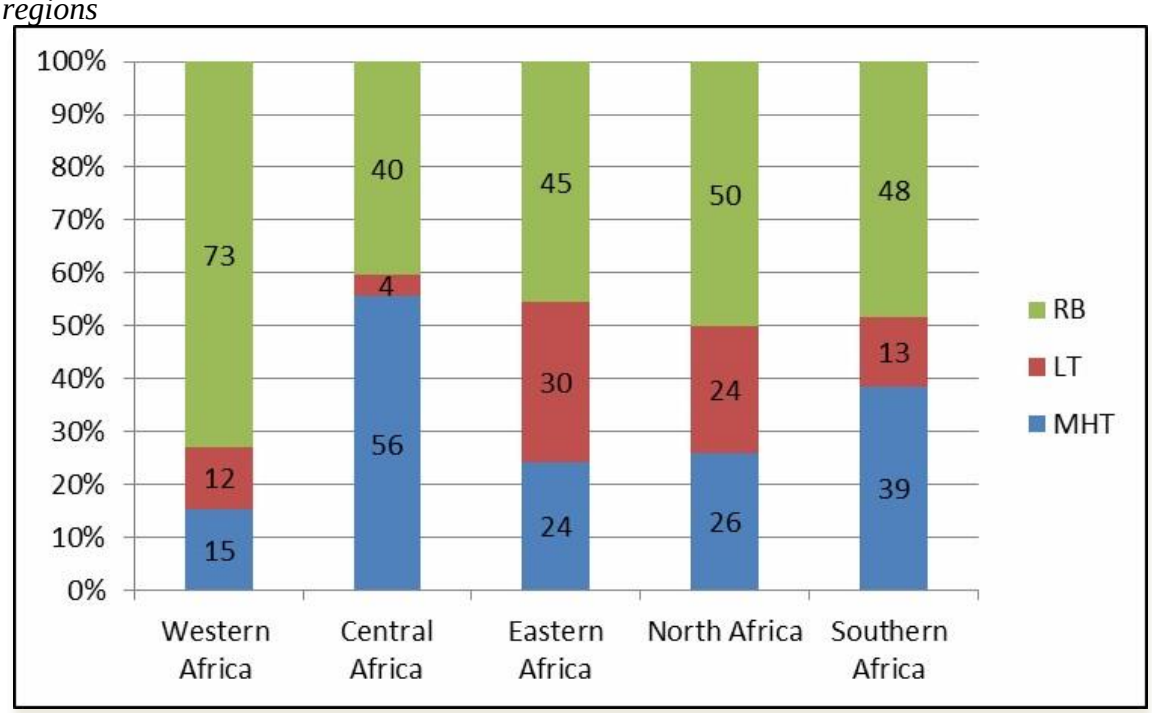


Source: UNIDO

The share of MHT manufactured exports is relatively low in all African regions (Figure 6). The manufactured exports of all African regions are dominated by resource-based, which range from 70% in Western Africa to 40% in Central Africa, and low-tech products, which vary from 30% in Eastern Africa to 4% in Central Africa. The latter with 56%, but with a tiny share of manufactured exports, and Southern Africa with 39%, the African region with the largest share of manufactured exports, are the regions with the highest share of MHT manufactured exports. North African manufactured exports show a comparatively large share in its total exports of the region. Resource-based products account for 51% of manufactured exports followed by low-tech exports with 25%.

Resource-based exports in Algeria and Libya account for 98.5 and 88.5%, respectively, of the total value of manufactured exports. Resource-based and low-tech products account for more than three quarters of Egypt's manufactured exports and three quarters of Moroccan ones. Tunisia, the country in the region with the highest share of manufactured exports, displays a higher share of MHT manufactured exports, which account for more than four-fifths.

Figure 1.6 Technological structures of manufactured exports, 2008–2012 – African regions



Source: UNSD

Manufactured trade has grown faster than manufacturing added value since 2006. This is explained by the increasing production share into multiple suppliers located in different countries. Such trend offers new opportunities for developing countries to benefit from international trade through inserting into international production networks (UNIDO, 2013a).

Despite a reduction in their growth rate, which dropped to 3.38% in 2008–2012 compared to 13.31% in 2004–2008, world's manufactured exports peaked at US$13,900 billion in 2012. Developing countries continued to increase their share in total manufactured exports from 26.1% in 2008 to 31.9% in 2012. Unfortunately, Africa's contribution to world's manufactured exports continues to be marginal and stagnated at 1.3% during 2008–2012. Jointly, Southern and North Africa accounted for 77% of African manufactured exports in 2012. Moreover, the share of North Africa in African manufactured exports has decreased from 44% to 36.4%. The decline in

demand in the main destinations of North African manufactured exports coupled with the negative impact of the political and social upheaval in the region partly explains such a decline. North African manufactured exports are almost evenly distributed among Egypt (27%), Morocco (25%), Algeria (24%) and Tunisia (23%).

African manufactured exports per capita reached US$250 in 2012. The per capita level ranges in Africa from US$34 in Eastern Africa to US$465 in Southern Africa. Western (23.1%) and Central Africa (19.45%) recorded very robust growth rates in 2008–2012 (Table 4).

Manufactured exports per capita stagnated in North Africa in 2008–2012 and recorded US$442 in 2012. This is half those of developing countries. Despite a decline, Tunisia recorded in North Africa the highest level of manufactured exports per capita, at US$1,381 in 2012, followed by Morocco, at US$517.

Table 1.4 Level and growth of manufactured exports per capita by region

Country group	*2008*	*2009*	*2010*	*2011*	*2012*	*Average annual growth rate (in %)*	
						2004–2008	2008–2012
Central Africa	144	149	173	208	293	14.37	19.45
Eastern Africa	22	22	21	32	34	20.01	11.28
North Africa	435	317	376	431	442	22.42	0.42
Southern Africa	374	276	357	416	465	12.19	5.60
Western Africa	53	45	92	121	121	–6.02	23.13
Africa	196	151	195	241	250	10.58	6.30
Developing countries	640	517	642	788	885	19.34	8.44

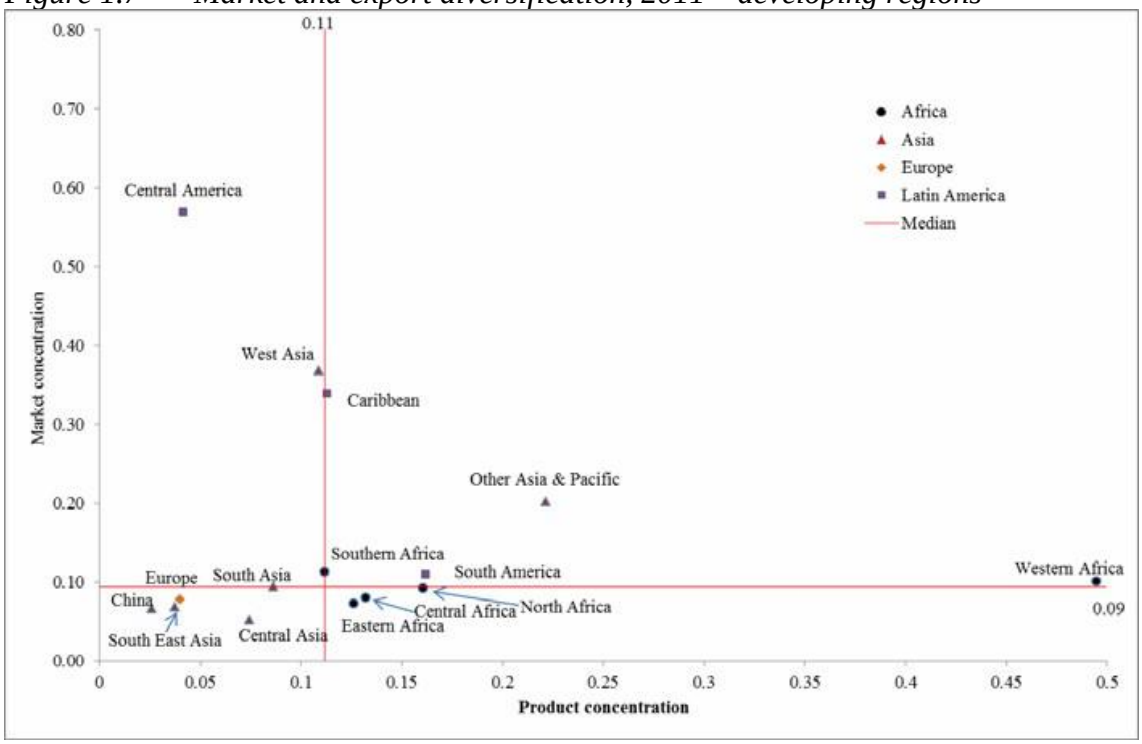
Source: UNSD

The concentration index of selected regions at the product and market level – the higher the index, the higher the concentration level is presented in Figure 7. To calculate concentration, we use the Herfindahl index. Using the median product concentration

(0.09), median market concentration (0.11), of selected world regions in 2011, and the graph can be divided into four zones to illustrate the relative concentration.

The top-right quadrant includes regions with relatively high product and market concentration such as Western Africa, top product concentration (0.495) within this group and among African regions, with two products accounting for more than half of its exports, namely petroleum products (48.1%) and petroleum gases with 10.66%. Other Asia and Pacific and South America (0.22) and the Caribbean, which top the market concentration (0.34) within this group, are also included in this quadrant. Southern Africa is also in this group but records the lowest product concentration (0.11) within Africa, with its top nine exports – including pearls, precious stones, iron ore concentrates, ore concentrates, pig iron, etc., accounting for 51% of its total exports. Regions in the bottom-right quadrant combine relatively low market concentration with high product concentration. Three African regions fall into this group, namely Eastern, Central and North Africa. The latter records the highest product concentration (0.16) within this group. Five products, petroleum products, liquefied propane, butane, fertilisers, elements distribution equipment and inorganic chemicals, account for more than half of its total exports. The top-left quadrant brings together regions such as Central America and West Asia with relatively diversified product exports to a few markets. Finally, the bottom-left quadrant displays the most diversified regions such as Europe and South East Asia. No African region is in this quadrant. All African regions thus show relatively strong product concentration and, albeit to a lesser extent, market concentration.

Figure 1.7 Market and export diversification, 2011 – developing regions



Source: Based on data from UNSD

The share of SSA exports to other African markets appear more sophisticated than those to Europe or North America, thereby presenting more growth-enhancing and learning opportunities for their manufacturing sectors (see, e.g., Klinger, 2009). Moreover, the share of manufacturing intra-African trade is higher than that outside Africa. despite a decline during the last ten years and levels comparatively lower than those of other regions as a result of enhanced competition and an increased interest in commodities due to a rise in their price (UNCTAD, 2013). Overall, SSA exports have already started reducing their concentration on OECD markets. The diversification mainly to Asia has, however, been driven by raw materials increasing their vulnerability due to their volatile prices. The intra-African trade of added-value products as well as added-value exports to Europe has increased. Diversification targeting emerging markets with products with higher added value coupled with investment in trade infrastructure and

simplified customs procedures would contribute to sustaining the economic growth of the region (ITC, 2012).

5 Conclusions and recommendations

This article examines the status of industrial development in North Africa during the period 2004–2012. We have analysed whether North Africa's manufacturing sector has experienced significant changes and has underpinned the region's growth. Our analysis sheds light on the status and the patterns of structural transformation of the region.

Our study suggests that, to varying extents, the manufacturing base of the North African region remains comparatively weak and its potential contributions to sustained economic growth of the region are far from being realised. Deindustrialisation thus remains a reality in the North Africa region where MVA accounts for barely one tenth of its GDP and the growth of its manufacturing sector lags behind that of its overall economy. The region has failed to spur industrial development and thus realise significant advances in terms of structural change.

Moreover, in line with Arbache et al. (2008), Haraguchi (2014) and Morris and Fessehaie (2014) our study suggests that different patterns can be described within the region in terms of development of the manufacturing sector. Two countries rich in natural resource, namely Algeria and Libya, present a weak manufacturing base, which calls for the urgent diversification of their economies, as they remain dependent almost exclusively on their natural resources, i.e., natural gas and oil. Despite having a relatively larger manufacturing base, the second group of countries, Tunisia, Egypt and Morocco, have witnessed the contribution of their manufacturing sectors to their economic growth stagnating or declining during recent years due, among other reasons, to the political and social changes they have undergone, and to their strong dependence

on a few markets which have suffered from a severe downturn. The latter situation has only exacerbated the trends recorded in previous years when North Africa's industrial sector failed to keep pace with that of the world's most dynamic developing regions.

With regard to international trade, North Africa continues to play a minor role in the world scene, even more in manufactured trade. Primary exports, which are exposed to the volatility of world prices, continue to lead the exports structure of North Africa. The benefits of the past commodities boom and regional economic growth have not been used to propel the necessary structural transformation of the region. Moreover, North African manufactured exports are dominated by resource-based and low-technology products and concentrate on a limited number of products and markets increasing thereby its vulnerability to external shocks as the recent world economic recession has proven.

The role that industrialisation plays in accelerating and sustaining growth has been recognised widely by African countries (AUC et al., 2015). They request international organisations to support their industrialisation, notably through the provision of policy advice and the delivery of technical cooperation program. Moreover, the international community has recognised the leading role of industrialisation for development. For the first time ever, the achievement of an inclusive and sustainable industrial development has been included in the international sustainable development agenda adopted in 2015 (UN, 2015). Jointly with infrastructure and innovation, industrialisation constitutes the sustainable development goal number nine, guaranteeing that due attention will be paid to it by the development community in the coming years. It is our view that to achieve the structural transformation of the North African region, the necessary resources, policies and technical support should be placed at the disposal of those countries.

Some authors, such as Rodrik (2015), point out that, overall, manufacturing accounts for a lower share of national economies and thereby the importance of industrialisation for developing countries might have diminished. We, on the other hand, remain convinced that industrialisation will continue to constitute the engine of future growth and that premature deindustrialisation, in line with research by UNIDO (2016) and Weiss and Jalilian (2015), may constitute a serious threat to the future growth of most developing countries. Haraguchi (2015) indicates that countries that have succeeded recently in industrialising did so faster than in the past, which might constitute an indication of the opportunities offered to developing countries by globalisation. Furthermore, the increasing demand and rising costs in Asia might offer an opportunity for Africa to sustain its growth through industrialisation. Nevertheless, this will not happen spontaneously. Strategies to break into international markets attract and develop firm capabilities and support agglomerations will play a key role (Page, 2012). Therefore, the future industrial development of North Africa might play a leading role in operating the necessary structural transformation of the region and ensure the sustained and significant economic growth necessary to create decent jobs and improve the living conditions of its population. But for that to happen the recent performance of the North African industrial sector will have to be reversed and its growth, sophistication and diversification, both in terms of production and trade, boosted.

Future research on the industrialisation of the North African region might include undertaking updates on the status of industrial development in the future. Moreover, it might be worth analysing the status and the main barriers constraining a regional integration which would enlarge the limited size of the domestic markets of the countries of the region and thus offer higher incentives to invest on the development of the region's industrial sector. Finally, one might consider measuring the size and

analysing the role of green manufacturing in the countries of the region. Green industrialisation might offer a promising and alternative path to conciliate economic growth with the respect of the environment and the conservation of the natural resources of the countries of the North African region.

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ARTÍCULO 2: OPTIMAL REGIONAL TRADE-INTEGRATION SCHEMES IN NORTH AFRICA: TOWARD A PRO-INDUSTRIALIZATION POLICY

Optimal Regional Trade-Integration Schemes in North Africa: Toward a Pro-Industrialization Policy

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Abstract

This article examines the status of industrial production in North African Countries as well as the role that regional trade integration through free-trade agreements and trade facilitation may play in spurring this region's reindustrialization. The study uses Applied General Equilibrium model to assess the potential impact of the establishment of a Continental Free Trade Area as well as the reduction of costs to trade across borders.

This article also measures the additional impact of the implementation of the Great Arab Free Trade Area and, finally, a deeper free trade agreement among North African countries and the European Union. The main findings indicate that each free-trade agreement configuration will stimulate, in relative terms, North African countries' exports from a number of main industries. Whereas industrial products represent the largest share of North African countries' export gains to Africa in general, mining and energy dominate North African countries' export gains to the rest of the Arab League and food dominates the exports to the European Union. Therefore, the establishment of the Continental Free Trade Area, accompanied by trade-facilitation measures, appears to be crucial in providing support for North African countries' industrialization.

JEL Classifications: F14, F15, F63, O14, O19

Keywords: Regional Trade Agreements, Industrialization, Trade Facilitation

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I. Introduction

The economic emergence of North African Countries[1] (NACs) requires a significant transformation of their economies and raises the question about their structural change. Despite their different levels of diversification, the economic performance of most countries in the North Africa region remains dependent on either commodity prices or weather conditions. North African economies are, in general, poorly diversified and specialized in only a handful of industries or non-dynamic products with low added value (EIB 2015). The high levels of unemployment, particularly among young people, call for the urgent creation of several million jobs in the region. Only a significant increase in economic growth can help meet this pressing challenge. Such an increase, often called explosive growth, has been experienced through structural change in either industries or services in the past. The growing participation in international trade, namely through manufactured exports, which are increasingly diverse and sophisticated, signifies a prominent engine to drive the structural transformation of successful developing countries.

[1] In this paper, NACs refers to Algeria, Egypt, Libya, Morocco, Tunisia, and Sudan. However, in the simulations, Sudan is not included with the rest of North Africa.

NACs began diversifying their structures in the 1960s and 1970s through state-led import-substitution strategies (Morocco, Tunisia) or heavy industrialization strategies (Algeria, Egypt). The diversification of their economies continued at different rates during the period of structural change in the 1980s and 1990s. As a result, the economic structures of most countries in the region changed between the mid-1980s and 2007, as demonstrated by the larger shares of industry and services in their economies. This change was also confirmed by the increase in diversification indices (Ben Hammouda et al. 2009), particularly in Egypt, Tunisia, and, to a lesser extent, Morocco. These countries' share in the global market of manufactured goods has, however, remained marginal at slightly above 1% between 1975 and 2008, while East Asia's share increased from 1.7 to 20% in the same period.

The apparent paradox between the level of diversification and international integration of NACs can be explained by several factors—on the one hand, by their relatively slow pace of diversification compared with that of the rest of the world and, on the other, by their focus on not necessarily the most dynamic global products concomitant with limited growth of Manufacturing Value Added (MVA). Moreover, North Africa's regional market has witnessed increasing competition from newcomers such as China, India, and Turkey. All of these factors have resulted in the currently limited integration of these countries into Global Value Chains (GVCs), which account for a significant share of global MVA.

Since 2008, North Africa's MVA growth rate has declined, as in almost all world regions, partly as a consequence of the overall global economic downturn. North Africa lags behind the world's most dynamic regions in terms of MVA per capita. Moreover, the existing gap has widened given the stagnant MVA per capita growth rate experienced in the 2008~2012 period (Moll de Alba 2014). Manufacturing plays a less

significant role in North Africa than in other developing regions. It has not expanded during the last decade and its contribution to the region's economy is limited. MVA represents one-tenth of the region's Gross Domestic Product (GDP), and the growth of the manufacturing sector lags behind that of the economy as a whole. The region has partly undergone a process of deindustrialization, whereas significant structural change has failed to take place during the last years.

The experience of developed as well as of emerging countries, particularly in Asia, demonstrates that that they have achieved real development (UNIDO 2009). Similarly, some studies show that the transition from being a low-middle income country takes place through the development of a strong and diversified economy, with the state playing a role in this process (Imbs and Wacziarg 2003). Recent research (UNIDO 2016) shows that manufacturing will still offer ample opportunities for developing countries to grow in the coming years. Haraguchi *et al.* (2016) confirm that manufacturing continues to offer prospects for developing countries, and they conclude that a small number of developing countries comprise a significant part of the MVA of this country grouping, whereas a large group of developing countries have failed to develop their manufacturing sector. For economies such as that of NACs, in which minerals and hydrocarbons are abundant, structural change should take place through the acceleration of the pace of diversification toward manufactured goods and through the introduction of more dynamic and efficient technologies. Indeed, the literature suggests that beyond economic diversification and exports, the nature of this particular diversification and sophistication in the process of production and exports serves as the lever for these economies to undertake structural shifts (Hausmann *et al.* 2007).

Active policy reforms have proven to play an important role in supporting this process. Trade policy can make significant contributions, particularly to increases in processing,

thereby leading to higher value added. Regional trade agreements may constitute a key instrument to raise NACs' participation in global trade. The positive growth prospects of the African continent may convert the Continental Free Trade Agreement (CFTA)[2] into a major ex-ante opportunity for NACs to expand their manufactured exports, given the continent's rapid urbanization and demographic evolution (UNECA 2014). This assumption needs to be assessed to measure the extent to which such trade reforms could play a pivotal role in NACs' reindustrialization. Besides the CFTA, NACs are involved in two other major regional integration processes, namely the Great Arab Free Trade Area (GAFTA) with the countries of the League of Arab States (LAS) and the Euro-Mediterranean Partnership (EUROMED) process with the EU.

Given the relatively modest size of NACs' economies—and in fact of the entire region—a deeper integration with not only the African continent but also the LAS countries and those within the EUROMED framework might strengthen the optimization of the region's comparative advantages. However, this process will not entail the same pattern of trade with each partner, particularly with regard to manufactured exports.

The purpose of this article is to assess different scenarios of regional integration with the main NAC trade partners and to identify the form of regional integration and trade agreements that would imply a higher level of industrialization of NACs.

This paper is structured as follows. After this general introduction, Section II provides an overview of recent developments in terms both of regional integration and industrial development. Section III presents the methodology and different scenarios for the regional trade integration analysis. Section IV discusses the main findings of the trade

[2] At the 2012 African Union (AU) Summit, African heads of state and governments endorsed an AU action plan for boosting intraAfrican trade and establishing the CFTA; it was agreed that the CFTA, for which negotiations were successfully launched at the June 2015 AU Summit, would be tentatively established by 2017.

reforms envisaged on the basis of NACs' trade and income performance. Finally, Section V provides a set of trade policy recommendations.

II. Overview of Recent Trends

A. Regional integration in North Africa

North Africa's regional integration process is limited and falls short of the ambitions expressed by the countries through different treaties and agreements; it can also be considered delayed, compared with developments in the rest of the continent. Indeed, if we consider the most evident and simple indicator—intra-regional trade—the performance of the region remains low: intra-regional exports represented only 6% of total exports in 2014, and intra-regional imports are 5% of imports. Even the nature of the trade is not in favor of strengthening economic links through regional value chains. The structure of intra-sub regional trade shows a predominance of low value-added goods since the sub-region's trade is mainly fuel (up to 43%) and other commodities (up to 18%).

The growth pattern over time shows an increasing gap in terms of low value-added goods, particularly fuels, the share of which has been increasing in recent years, from less than 30% of trade in 2010 to more than 43% in 2013.

The impact of the events experienced by the sub-region since 2011 is particularly obvious for manufactures, the share of which declined by 24%; however, the share of commodities, including fuels, showed positive growth rates in the same period.

Nearly two thirds of intra-North African trade is provided by Algeria (36%) and Egypt (30%). Tunisia comes third with 17%, whereas the share of Sudan and Mauritania is less than 1%.

At the institutional level, the only Regional Economic Community (REC) in North Africa is the Arab Maghreb Union (AMU), which was established in 1989 in Marrakech through a treaty signed by Algeria, Libya, Mauritania, Morocco, and Tunisia. Although this REC has an ambitious agenda and aims to organize an economically integrated space in the Maghreb region and set up common policies in all domains, it has, so far, been unsuccessful in implementing a deep regional integration process. The five signatory countries have just finalized the negotiations around the Free Trade Area (FTA), which is expected to start late 2016, despite it being scheduled for 1992 according to the Marrakech treaty.

One of the most common reasons given for these delays is the regular political tensions arising during the last 25 years between some AMU member states. However, in several regional integration processes, existing political tensions between countries were not a hindering factor, compared with the potential economic and social gains related to the deep integration process. In the case of AMU, political tensions become an obstacle for reasons linked to the Treaty establishing the AMU. Indeed, this Treaty stipulates (article 4) that the Union is endowed with a council of Presidency consisted of the members' Heads of States and which is the supreme organ of the Union. Article 6 clarifies that only the Presidential Council is authorized to make decisions and its decisions shall be taken unanimously.

These two articles have serious implications for the regional integration process. Indeed, it means that all decisions to be implemented should be taken by heads of state. Given the political tensions that exist between countries in the region and taking into account the political situation in Libya, which has faced the absence of a strong unified government since the Arab Spring in 2011, it is obvious that the regional integration

process in the Maghreb is completely frozen, as the last summit for heads of states was held back in 1994.

Regarding Egypt and Sudan, both these countries are members of the Common Market for Eastern and Southern Africa (COMESA), and since June 2015, they have taken part in the tripartite agreement, signed in Sharm Echeikh, that merged COMESA with the South African Development Community (SADC) and East African Community (EAC), involving 26 African countries. This new dynamic is expected to stimulate a broader agenda that includes all other African countries through continent-wide reform.

B. Industrial development status

Africa's manufacturing sector is underdeveloped (Bigsten and Söderbom 2011, Lall 2005, UNIDO 2009, 2013a, 2013b, UNCTAD and UNIDO 2011), as is the North African manufacturing sector, which has had minimal impact on the region's economic growth. The region has missed the opportunities offered by past commodities booms. Moreover, the impact of the global economic and financial crisis of 2008, together with the social and political changes of 2009 and 2011 affecting some countries in the region, have resulted in a significant slowdown of industrial performance.

North Africa experienced a decline in its MVA growth rate, which dropped to 1.67% in the 2008~2013 period. The region displayed the highest MVA per capita within Africa (276 US dollars) in 2013 but experienced only a marginal increase of 0.20% during 2008~2013. North Africa increased its MVA per capita marginally by 2 US dollars in the 2008~2013 period, compared with a 108 US dollars increase in developing countries during the same period.

The average annual MVA growth rates declined during 2008~2013 in all countries within the region compared with the previous period. Egypt, with more than 40% of the

region's MVA, saw its growth rate halved to 2.73%, whereas Libya's growth rate dropped to −12.93%.

As a result, NACs recorded reductions in their MVA per capita average growth rates. Tunisia serves as the exception, having experienced a higher growth rate per capita in the 2008~2013 period than in the 2003~2008 period. Tunisia topped the per capita value in North Africa at 634 US dollars, nearly double that of Morocco. Both Algeria and Libya experienced declines in their MVA per capita during 2008~2013, 181 to 170 US dollars and from 431 to 204 US dollars, respectively.

Nonetheless, North Africa, jointly with Southern Africa, still accounts for the largest share of Africa's MVA. They also display the largest share of Medium- and HighTechnology (MHT) products in the region—23% in the case of North Africa. Resourcebased activities, however, account for almost half of North Africa's MVA.

Overall, Africa's industrialization level declined to a low 9.88% share of MVA in GDP in 2013. This trend experienced by the continent over the 1950~2005 period (Szirmai 2012)—with manufacturing following a flat trajectory to reach a share of 11 percent MVA in GDP in 2005, equivalent to that of 1950—has, unfortunately, not been reversed. Page (2012) confirms that Africa has deindustrialized since the 1970s and that the continent requires structural changes to ensure and sustain future growth. However, the challenge to accelerate and sustain the growth of Sub-Saharan Africa persists (Abarche *et al.* 2008) despite some progress.

North Africa does not constitute, unfortunately, a different case in the continent: that is to say, the percentage of MVA in GDP declined to 10.40% in 2013. Africa's manufacturing sector grew at a slower pace than its economy during 2008~2013. Africa's recent economic growth has not been accompanied by significant structural

change. This trend is confirmed by its declining growth rates during 2008~2013. North Africa displays a similar performance as its MVA grew slower than its GDP.

North Africa's manufacturing is weak and thus contains ample scope to further contribute to boosting and sustaining the region's economic growth. North Africa continues to represent a marginal share of the world's manufacturing added value and manufactured exports (Upadhyaya and Mirzaei Yeganeh 2015). Due to, among other reasons, the political and social changes of 2009 and 2011 and the strong dependence on a handful of markets that have suffered severe downturns since 2008, Egypt, Tunisia, and Morocco, which have the region's largest industrial sectors, have witnessed either a decline or stagnation of the manufacturing sector and its contribution to the countries' economic growth. The region has, unfortunately, not made use of past commodity booms and related economic growth to propel its structural transformation.

III. Methodology

A. Main model

This analysis relies on the Modelling International Relationships in Applied General Equilibrium (MIRAGE) multi-country, multi-sector Computable General Equilibrium (CGE) model, which is particularly well suited for trade policy analysis. The dynamic version of the model is utilized with its standard closure. The dynamic is recursive, implying a succession of equilibria being solved sequentially from one year to another[3].The model relies on the Global Trade Analysis Project (GTAP) database version 8.1[4] 4 for macroeconomic and bilateral trade data, whereas the Market Access Map at Harmonized System 6-digit (MAcMap-HS6) database version 2 is employed for

[3] See Decreux and Valin (2007) for a full description of the model features.

[4] See Narayanan et al. (2012).

bilateral protection information. The MAcMap-HS6 database is updated with key developments to date (such as the Everything But Arm (EBA) initiative, the African Growth and Opportunity Act (AGOA) and expansion of the EU to 28 members).

Considering both the solver's limitations and GTAP database's constraints in terms of geographic and sectoral details, simulations are conducted with a total of 14 countries or regions and 29 industries. As the focus here is on North Africa, all NACs available in the GTAP version 8.1 database are retained.[5] The remaining African countries are categorized into 4 other African regions. The main trading partners (i.e., the EU, the United States, and China) are also retained as they are available in the database, whereas all other countries and regions are aggregated into two groups: Emerging Industrialized Economies (EIE), and Rest of the World (see Appendix 1).

Regarding sectoral aggregation, emphasis is placed on manufacturing industries that are incremental for NACs' structural transformation. In other words, as many details as possible were retained for these industries. In total, 29 industries were considered, which can be decomposed into Agriculture (1), Food (7), Industrial Manufacturing (16), Mining and Energy (3), and Service Sectors (2) (see Appendix 2).

B. Description of trade reforms

Three sets of trade reforms are assumed based on North African countries' ongoing efforts to broaden trade integration with their African, Arab and Euro Mediterranean partners. Each set of reforms builds on each other in the sense that the first set of scenarios envisages only North Africa's engagement with its African partners. The second set of scenarios, more ambitious, considers not only pan-African integration but

[5] It should be noted that Algeria and Libya are lumped together into the GTAP database under the Rest of North Africa region; therefore, results from the simulation exercise cannot be drawn for these two countries separately. Similarly, Sudan is part of the Rest of Eastern Africa region in the GTAP database.

also pan-Arab integration. The third set of scenarios assumes that North African economies have been able to successfully integrate with their trading partners from the African, Arab and Euro Mediterranean regions. The objective being to assess whether the level of industrialization of NACs vary significantly with the envisaged integration reforms. Greater details on each of the three sets of trade reforms are provided thereafter.

Firstly, a clear roadmap for Africa's regional integration process was initially provided[6], by the Abuja Treaty, which came into effect in 1994. In accordance with the Treaty African heads of state and government agreed in January 2012—by endorsing the African Union Action Plan for Boosting Intra-African Trade and the Establishment of a Continental Free Trade Area—to set up a CFTA, with 2017 as the tentative target. CFTA negotiations have officially been launched at the June 2015 African Union Summit in South Africa, with objective date to launch the CFTA unchanged. Accordingly, the first scenario devised in this analysis assumes that all tariff barriers on goods within the African continent will be removed by 2017. An alternative scenario is to consider a reduction of costs to trade across borders in addition to the trade liberalization associated with the CFTA, assuming that all countries implement the trade facilitation part of the WTO agreement reached in December 2013, referred to as the Bali package. These trade costs are obtained by crossing information on (1) the average number of days required for export and import processes (World Bank 2013) and (2) export- and importweighted average time costs obtained at the GTAP level of industries. The trade costs were also obtained by exporting and importing countries/regions (Minor and Hummels 2011). 25% reductions of these trade costs, or

[6] It should be noted that if the CFTA was not specifically mentioned in the Abuja Treaty it was implicitly required by the indication of the need for Africa to come up with its Continental Customs Union (i.e. a CFTA with a single common external tariff structure for all African countries *vis-à-vis* partners from outside Africa) by 2019.

iceberg costs, were then applied, such as customs procedures, port handling, and inland transport in import and export processes, which are assumed to become more efficient worldwide by 2017 compared with the base year. The assumption is that reforms will lead to improved productivity (PortugalPerez and Wilson 2010) and, in particular, improve the competitiveness of manufactured industrial products. Trade facilitation can boost productivity; Karingi and Spence (2011) confirm these results on TFP from a sample of 18 African countries and indicate that trade facilitation can also influence production, catalyzing a transition toward more sophisticated exports and greater future growth.

The second set of scenarios is based on the first, with an additional FTA within the GAFTA framework. The implementation of the Pan-Arab FTA has already started in most Arab countries. However, in many cases, product coverage is low and exclusion lists of sensitive products are important. In this scenario, we assume a full FTA by 2017, without any exceptions. As for the first scenario, we assess an alternative reform that includes a 25% reduction in the costs of trade across borders by 2017.

The third set of scenarios is based on the second set, to which we add a comprehensive FTA between NACs and EU countries. This scenario is an expansion of the current bilateral EUROMED agreement—which focuses on manufactured products—to all industries by 2017, without exclusion. As for the previous set of scenarios, an additional reform including a 25% reduction of costs of trade across borders by 2017 is envisaged.While the reforms can be assumed to be in force as from 2017[7], the outcomes are given for the year 2020 in order for all variables of the model to properly adjust to shocks. Unless otherwise indicated, these annual outcomes are based on a comparison

[7] Following the decision to tentatively establish a CFTA by 2017, all scenarios in this study are to be fully implemented by 2017 for consistency and comparisons made possible across scenarios.

between the scenarios and the reference (or baseline; i.e. without trade reforms), either in percent or in absolute changes.

IV. Economic Impact of Implemented Reforms

A. Impact of different scenarios on export

1. Only the CFTA in place

Implementation of the first scenario will have a significant impact on African countries' exports, which would significantly increase. North African exports would rise by 2.7% (or 8.9 billion US dollars), whereas the rest of Africa will experience an export increase of 8.2% (or 42.4 billion US dollars) in 2020 compared with the baseline (Table 1). The impact on other countries would remain very limited, as third countries (i.e., countries from outside Africa) would see their exports slightly decrease; for example, by a maximum of 0.2% in the case of the EU.

An increase in Africa's exports would essentially be the result of a boost in intraAfrican trade, which would expand (in absolute terms) by nearly 70 billion US dollars in 2020. North African exporters would receive as much as 20% of this gain (i.e., 13.6 billion US dollars), 52% of which would be attributable to an expansion in intra-North African trade alone (i.e., 7.1 billion US dollars) and the rest to increased exports by

NACs to the rest of Africa (i.e., 6.5 billion US dollars). North African exports to the rest of the world would decrease by 4.7 billion US dollars (Appendix 4).

The reverse can be observed for the rest of Africa, where an increase in exports from one regional country to another (+ 52 billion US dollars) is expected, which is considerably larger than their exports to North Africa (+3.8 billion US dollars) in absolute terms. Yet, in relative terms (i.e., percentage), exports from African countries (excluding North Africa) to North African economies would increase (+114.3%) more

than exports to each other (+72.7%), owing to much larger increases in exports to North Africa, Central Africa, and Southern Africa than to their African partners outside North Africa (Appendix 3). In fact, in relative terms, all NACs, with the exception of Egypt, could expand their trade with African partners outside North Africa (this would be particularly evident in the case of Morocco).

Third countries would export less to African economies, redirecting some of their trade toward non-African partners; but in net, as indicated earlier, the CFTA reform would be slightly trade diverting for third countries.

Table 2.1 Changes in total export

(in 2020)

	CFTA		**CFTA+TF**	
	%	US$ billion	%	US$ billion
China	0.1	-2.0	8.7	257.1
European Union	-0.2	-6.2	5.3	158.3
United States	-0.1	-1.1	6.2	120.7
North Africa	2.7	8.9	6.3	20.4
Algeria & Libya	1.0	1.8	3.4	5.9
Egypt	3.2	2.7	7.5	6.2
Morocco	6.0	2.1	10.7	3.8
Tunisia	6.8	2.3	13.2	4.4
Rest of Arab League	-0.1	-0.5	4.1	35.9
Rest of Africa	8.2	42.4	15.6	80.8
Central Africa	3.2	3.5	7.0	7.5
Western Africa	13.2	21.3	18.1	29.1
Eastern Africa	9.8	9.1	20.8	19.2
Southern Africa	5.4	8.6	15.8	25.0
Emerging Industrialized Economies	-0.1	-2.1	8.3	196.0
Rest of the World	0.0	-2.0	6.5	391.8

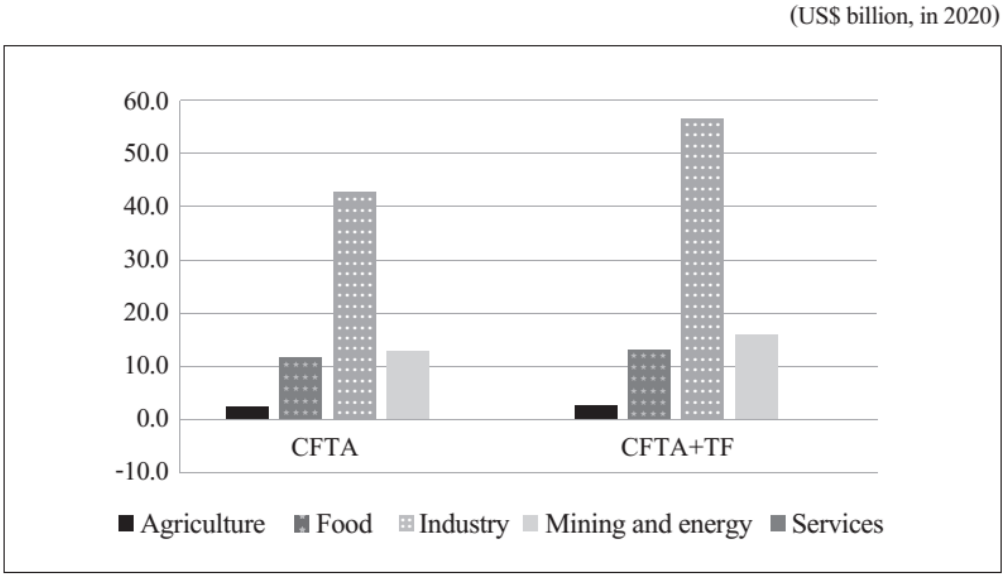
(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

The improvement of trade-facilitation measures (i.e., reduced costs to trade across borders) would considerably enhance export gains for Africa and also stimulate exports for third countries, thereby reversing the negative effects these economies would experience from the CFTA reform alone.

Trade expansion can be observed for nearly all bilateral relationships; elsewhere, variations would be reduced thanks to trade facilitation reforms. It is also important to note that African countries (both North African and the rest of the continent) would be able to capture significant export opportunities not only within Africa, on account of the CFTA, but also outside of Africa because of trade-facilitation measures that would improve their competitiveness in foreign markets (Appendix 5 and Appendix 6).

As the primary change in exports following implementation of the CFTA relates to trade within the continent, we focus our analysis on changes in intra-African trade and intra-North-African trade by main sectors.

Figure 2.1 Changes in intra-African trade



(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

In absolute terms (following the establishment of the CFTA), intra-African trade would see the biggest increases in industrial products (42.7 billion US dollars), bringing positive implications for Africa's industrialization. The industrial content of intra-African trade would expand further if trade-facilitation measures were improved in addition to the CFTA (at 61.5% and 64.3% of the increase in intra-African trade

explained by industrial sectors alone following the introduction of the CFTA and CFTA + trade facilitation, respectively).

These results indicate that (1) the CFTA has a positive bias toward the industrial products trade and (2) trade-facilitation measures will increase trade of industrial products compared with other product categories (Figure 1). Indeed, trade-facilitation measures, in addition to the CFTA reform, will further increase intra-African trade of industrial products by 14 billion US dollars (21%), whereas additional increases would only be 0.3 billion US dollars (1%), USD 1.4 (19%), and USD 3.1 (14%) in agriculture, food, and mining and energy, respectively.

It should be stressed that initial trade conditions play an important role in shaping the results. The share of industrial products in intra-African trade tends to dominate, whereas exports from African countries to the rest of the world are largely skewed toward raw materials and energy commodities (Mevel and Karingi 2013). This also holds in the case of NACs (Appendix 7).

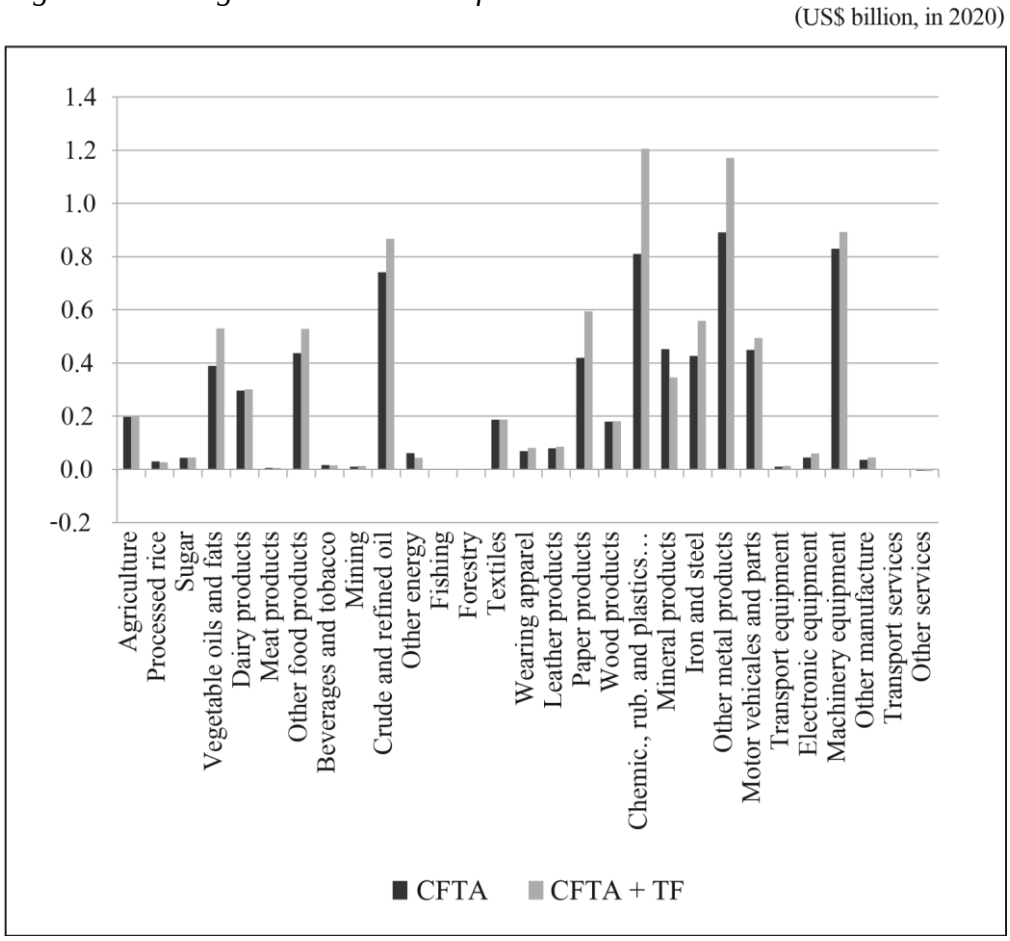
Furthermore, trade of intermediate products within the continent as well as with the rest of the world will increase, owing to trade-facilitation reforms, and will impact on the trade of final products. Trade-facilitation measures could have a significant impact on the incorporation into the global value chains as well, in addition to spurring the development of regional value chains across the continent or within North Africa; according to Portugal-Perez and Wilson (2010), trade facilitation can boost productivity.

Focusing solely on NACs' exports to all of Africa, the above conditions still hold; 59.0% and 61.4% of the increase in North African exports to all of Africa are concentrated in industrial sectors alone following implementation of the CFTA and the CFTA accompanied by efforts to facilitate trade across borders, respectively.

However, focusing only on intra-North African trade, the positive impact of the CFTA and trade facilitation reforms in industrialization would be much more pronounced (with about 68.8% and 69.7% of the increase in intra-African trade concentrated in industrial sectors alone following implementation of the CFTA without and with trade-facilitation reforms, respectively).

At the sector level, although crude and processed oil represent a significant share (namely 10%) of the increase in intra-North African trade following CFTA reforms, the largest expansion would be for industrial products—chemicals, metals, and motor vehicles and parts—and machinery equipment; the increase in processed foods would also be significant for vegetable oils, dairy products, and other food products (Figure 2). The adoption of trade-facilitation measures would favor most intra-North African trade in vegetable oils, mining, paper products, chemicals, metals, and electronic equipment; intra-trade in those industries would increase by at least an additional 25% with a reduction of costs to trade across borders compared with conditions in the CFTA without trade facilitation.

Figure 2.2 Changes in intra-North African trade



(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model

2. Pan-Arab FTA + CFTA in place

The second set of scenarios implies an additional FTA with Arab League countries in addition to the CFTA. Against this background, the significant increase in intra-African trade attributable to the CFTA is complemented by a substantial increase in intra-Arab League trade (i.e., North Africa plus the rest of the Arab League), which would expand (in absolute terms) by nearly 15 billion US dollars in 2020. Export benefits for NACs alone would rise by an additional 3.8 billion US dollars compared with the scenario wherein only the CFTA is in place (i.e., 12.7 billion US dollars with both Pan-Arab FTA and CFTA versus 8.9 billion US dollars with only the CFTA). Countries from the rest of the Arab League would shift from a net trade diversion situation under the CFTA

alone to a net trade creation situation if a Pan-Arab FTA is established in addition to the CFTA reform.

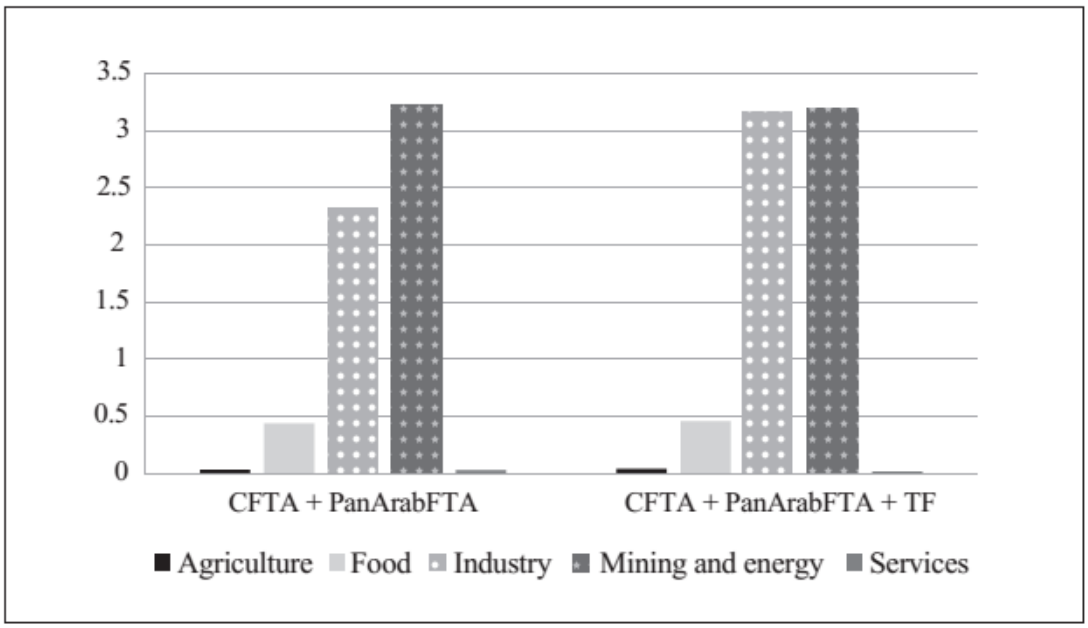
The trade diversion for intra-African trade is very limited (based on the fact that some NACs tend to export more to the rest of the Arab League at the expense of exports to partners from North Africa as well as the rest of Africa): intra-African trade would increase by 69.5 billion US dollars and 68.9 billion US dollars with the CFTA and the CFTA plus the Pan-Arab FTA, respectively. Third-party countries' exports to the Arab League (North Africa and rest of the Arab League) would drop further (compared with the situation wherein only the CFTA is implemented), but this trade diversion effect for third-party countries would remain fairly limited.

Trade facilitation would considerably expand the benefits for all Arab League countries, whereas for other countries (i.e., those outside the Arab League), benefits from trade facilitation would remain nearly unchanged compared with those enjoyed under the CFTA reform alone.

As far as intra-Arab League trade is concerned, a Pan-Arab FTA would drive industrial products the most. However, it is worth noting that if the CFTA stimulates intra-African trade in food products more than in mining/energy and agriculture, a PanArab FTA would stimulate intra-Arab League trade in mining and energy significantly more than in food and agricultural products. This would specifically be driven by (1) the sharp increase in mining and energy exports from North Africa to the rest of the Arab League following the implementation of the Pan-Arab FTA (Figure 3), (2) a significant increase in the rest of the Arab League countries' exports to NACs, and (3) a noticeable increase in intra-Rest of Arab League's (excluding NACs) trade in mining and energy.

Figure 2.3 Changes in North African countries' exports to the Arab League

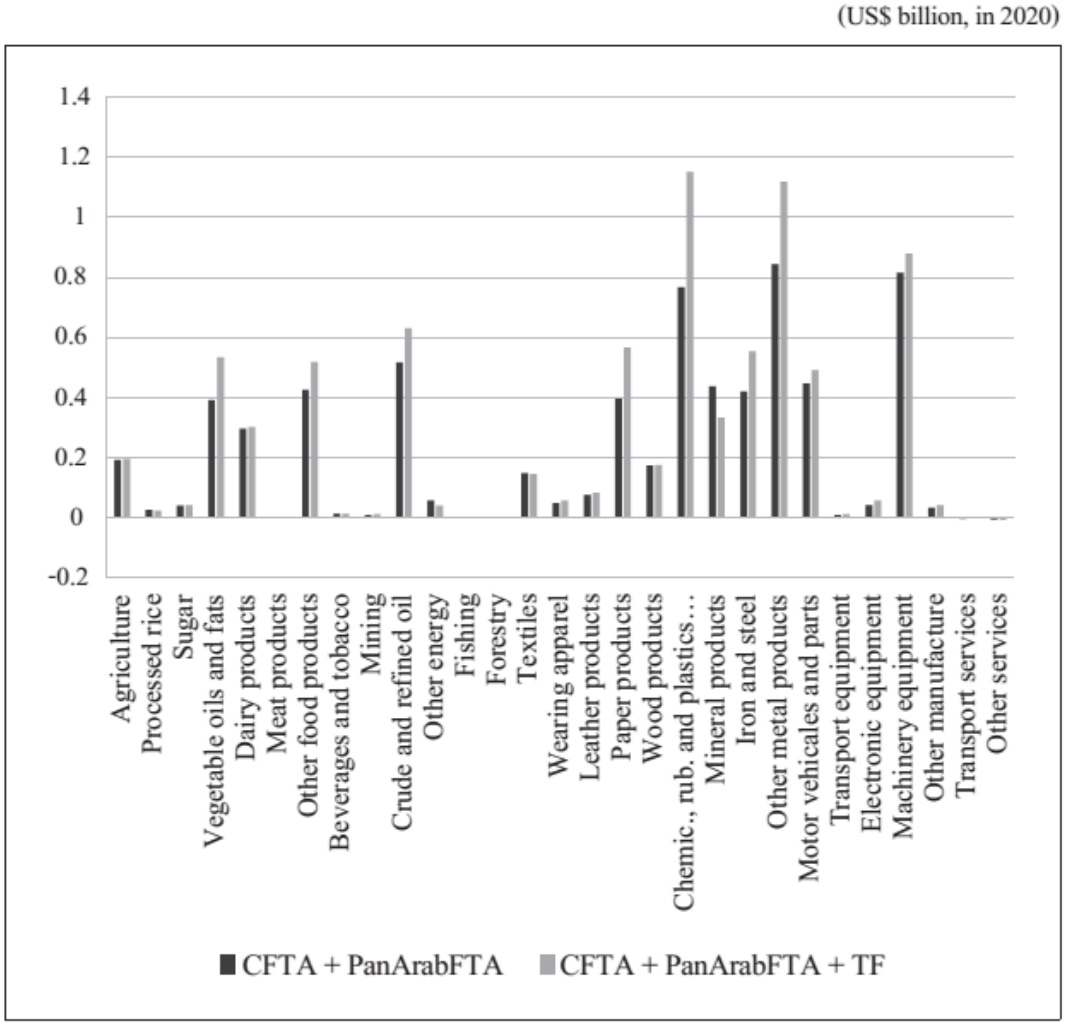
(US$ billion, in 2020)



(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

Intra-North African trade gains would, as mentioned earlier, only fall slightly if the Pan-Arab FTA were introduced in addition to the CFTA, simply because NACs would seize export opportunities from the rest of the Arab League, thereby increasing their exports to their North African counterparts and to their counterparts from the rest of Africa to a lesser extent than with the implementation of the CFTA only. Yet, this would not undermine the industrialization of intra-North African trade with or without tradefacilitation measures (Figure 4).

Figure 2.4 Changes in intra-North African trade



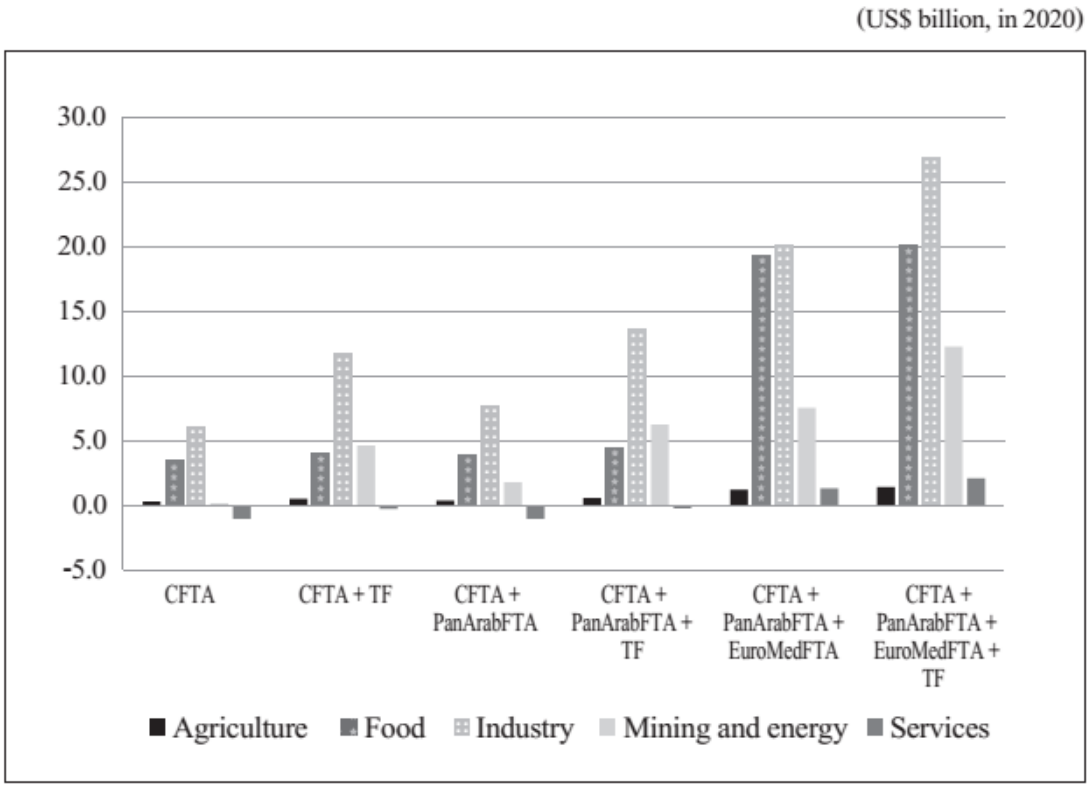
(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

Next, analyzing the trade within the rest of the Arab League, industrial products would also see particular stimulation, and the benefits of having a Pan-Arab FTA in place are clear. Benefits for mining and energy products in intra-trade expansion (as highlighted earlier) are also evident; it is interesting to note that trade-facilitation measures matter tremendously for intra-Arab League trade in industrial products (as this sector makes the most impressive progress in relative terms with additional tradefacilitation reforms than without). This result confirms, in a more pronounced way, the previous result in the case of the introduction of the CFTA together with tradefacilitation measures.

3. EUROMED FTA + CFTA and Pan-Arab FTA

If a EUROMED FTA were established in addition to both CFTA and Pan-Arab FTA, trade creation would become significant. More precisely, exports to the EU and all other countries of the Mediterranean alliance would rise considerably. Exports from the EU would move from a contraction of about 8 billion US dollars with the introduction of the CFTA plus the Pan-Arab FTA to 36 billion US dollars if a EUROMEDFTA were also established. Export benefits would nearly quadruple for North Africa as a whole (in absolute terms, with the largest expansions for Morocco and Tunisia) compared with a situation wherein only CFTA and Pan-Arab FTA are in place. The larger the free trade area, the greater the export gains would be for North Africa; trade-facilitation measures would further compound the benefits, with export gains in industrial products always the highest in absolute terms. However, in the case of the Arab League—as seen previously, albeit much more pronounced under EUROMED—the share of industrial exports is considerably reduced due to the sizeable increase in North Africa's exports of food as well as energy and mining (Figure 5).

Figure 2.5 Changes in North Africa's total exports



(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

The remaining countries that are part of EUROMED would register relatively more limited additional gains in terms of their exports (in particular, countries from the rest of the Arab League) from the benefits already derived from the CFTA and the Pan-Arab FTA.

Given the relevant size effect, countries outside EUROMED would witness a decline in exports compared with the CFTA and Pan-Arab FTA following increased trade and higher competition within the EUROMED area.

Table 2.2 Changes in total exports

(US$ billion, in 2020)

	CFTA	**CFTA + TF**	**CFTA+ PanArabFTA**	**CFTA+ PanArabFTA + TF**	**CFTA+ PanArabFTA + EuroMedFTA**	**CFTA+ PanArabFTA+ EuroMedFTA +TF**
China	-2.0	257.1	-2.7	256.3	-4.8	254.0
European Union	-6.2	158.3	-8.1	156.2	36.0	202.6
United States	-1.1	120.7	-1.4	120.3	-3.3	118.4
North Africa	8.9	20.4	12.7	24.5	49.2	62.2
Algeria & Libya	1.8	5.9	2.4	6.6	7.2	11.7
Egypt	2.7	6.2	4.9	8.7	12.7	16.7
Morocco	2.1	3.8	2.8	4.5	15.5	17.7
Tunisia	2.3	4.4	2.6	4.8	13.8	16.3
Rest of Arab League	-0.5	35.9	11.2	48.5	12.3	49.5
Rest of Africa	42.4	80.8	42.6	81.1	42.3	80.7
Central Africa	3.5	7.5	3.5	7.5	3.4	7.4
Western Africa	21.3	29.1	21.3	29.1	21.3	29.2
Eastern Africa	9.1	19.2	9.4	19.6	9.3	19.5
Southern Africa	8.6	25.0	8.5	24.9	8.2	24.7
Emerging Industrialized Economies	-2.1	196.0	-3.0	195.1	-2.7	195.5
Rest of the World	-2.0	391.8	-3.6	390.1	-5.8	387.7

(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

As observed in other scenarios, trade facilitation would play a very positive role in all countries' trade, expanding gains for EUROMED countries and more than compensating others for possible trade diversions (Table 2). For NACs, each FTA seems likely to stimulate, in relative terms, different main sectors. The breakdown by destination can help better understand these aspects (Table 3). Industrial products represent the largest share of North Africa's export gains to Africa (North Africa as well as the rest of Africa), whereas mining and energy dominate North Africa's export gains to the rest of the Arab League; and food dominates North Africa's exports to the EU.

Table 2.3 Changes in exports from North Africa to main destinations

(%, in 2020)

	CFTA	**CFTA+ TF**	**CFTA+ PanArabFTA**	**CFTA+ PanArabFTA +TF**	**CFTA+ PanArabFTA+ EuroMedFTA**	**CFTA+ PanArabFTA+ EuroMedFTA+ TF**
	North Africa's exports to EU					
Agricultural	-0.1	0.1	-0.1	0.1	0.6	0.8
Food	-0.1	0.0	-0.1	0.0	14.6	15.1
Industry	-1.5	1.3	-1.3	1.6	8.2	11.9
Mining and energy	-0.6	2.9	-1.2	2.3	3.1	6.8
Services	-0.4	0.0	-0.4	0.0	0.6	1.0
Total	-2.8	4.3	-3.2	4.0	27.1	35.6
	North Africa's exports to North African pa tners					
Agricultural	0.2	0.2	0.2	0.2	0.1	0.1
Food	1.2	1.5	1.2	1.4	0.9	1.1
Industry	4.9	5.9	4.7	5.7	2.7	3.4
Mining and energy	0.8	0.9	0.6	0.7	0.2	0.3
Services	0.0	0.0	0.0	0.0	0.0	0.0
Total	7.1	8.5	6.7	8.0	3.9	4.9
	North Africa's exports to rest of Africa					
Agricultural	0.3	0.3	0.3	0.3	0.3	0.3
Food	2.5	2.6	2.5	2.6	3.2	3.3
Industry	3.2	3.7	3.2	3.7	4.3	4.9
Mining and energy	0.6	0.6	0.6	0.6	0.6	0.6
Services	0.0	0.0	0.0	0.0	0.0	0.0
Total	6.5	7.1	6.5	7.2	8.4	9.1
	North Africa's exports to rest of Arab League					
Agricultural	0.0	0.0	0.0	0.0	0.0	0.0
Food	-0.1	0.0	0.3	0.3	0.4	0.5
Industry	-0.1	0.5	1.6	2.3	2.3	3.2
Mining and energy	-0.1	0.0	3.3	3.3	3.2	3.2
Services	0.0	-0.1	0.0	0.0	0.0	0.0
Total	-0.3	0.4	5.2	5.9	6.1	6.9

(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

B. Changes in tariff revenues and real incomes

Tariff liberalization reforms imply relatively large cuts in tariff revenues, especially for NACs (Table 4). However, this impact differs from one country to another. While Algeria and Libya are the most negatively affected countries if the CFTA and the PanArab FTA are established, the tariff revenue impact is the most negative for Morocco and Tunisia in the event of EUROMED's establishment. The impact is more than 10 times greater for the entire region if EUROMED is implemented (−58.8%),

compared with the consequences of only the CFTA being established (−5.6%); a Pan-Arab FTA would only double the fiscal impact compared with the situation with the CFTA reform alone, and Morocco would feel a strong impact. This is consistent with efforts to pursue this scenario, as the deeper the FTA reforms, the larger the liberalization efforts and the greater the drop in tariff revenues.

Table 2.4 Changes in tariff revenues

(%, in 2020)

	CFTA	**CFTA+ TF**	**CFTA+ PanArabFTA**	**CFTA+ PanArabFTA+ TF**	**CFTA+ PanArabFTA+ EuroMedFTA**	**CFTA+ PanArabFTA+ EuroMedFTA+ TF**
European Union	-0.1	4.8	-0.1	4.7	-1.3	3.4
North Africa	-5.6	-3.8	-10.3	-8.9	-58.8	-58.2
Algeria & Libya	-11.5	-10.6	-15.5	-15.0	-44.6	-44.2
Egypt	-1.8	1.2	-6.5	-4.2	-56.7	-55.1
Morocco	-2.6	-1.5	-9.2	-8.2	-71.9	-72.0
Tunisia	-1.3	2.5	-5.1	-1.6	-74.7	-74.0
Rest of Arab League	-0.1	1.4	-7.5	-6.4	-13.7	-12.6
Rest of Africa	-25.3	-21.7	-25.6	-22.0	-26.4	-22.7
Central Africa	-31.5	-30.0	-31.5	-30.0	-32.0	-30.6
Western Africa	-33.4	-30.6	-33.4	-30.6	-34.5	-31.7
Eastern Africa	-29.4	-26.2	-30.5	-27.3	-30.8	-27.7
Southern Africa	7.2	15.4	7.1	15.3	6.4	14.5

(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model.

The implementation of trade-facilitation measures will, however, reduce the relatively negative tariff revenue impact in all scenarios. This is not surprising as trade-facilitation measures envisaged in the modeling exercise partly aim at improving cross-border (including customs) procedures, thereby making tariff revenue collection more efficient. Indeed, if trade-facilitation measures were implemented alone (i.e., without any of the tariff cuts implied by regional integration reforms), then trade would be boosted and tariff revenues would increase following the improvement of customs procedures and revenue collection. While NACs are expected to implement liberalization reforms in the context of the CFTA, GAFTA, and EUROMED, alongside the adoption of measures to

facilitate trade across borders with all partners in conformity with the WTO Bali agreement, revenue collection will improve, especially *vis-à-vis* partners that will remain outside regional trade arrangements to which North Africa will not be (immediately) granting preferential market access.[8] The reduction of the relatively negative tariff revenue effect through the adoption of trade-facilitation measures is particularly pronounced in the case of CFTA reforms alone, as customs procedures are often less efficient within Africa than between Africa and the rest of the world.

This negative effect does not considerably impact real incomes, which are either only slightly negative or slightly positive, depending on the trade reforms; however, adoption of trade-facilitation measures has positive impacts on all countries' real income level and even offsets possible negative effects of liberalization reforms (Table 5), particularly given large trade gains leading to improved terms of trade and reallocation of resources toward the most efficient factors of production as well as improved tariff revenue collection.

[8] In the case of Nepal's or Pakistan's custom reforms, annual customs revenue grew significantly following the reforms (www.wbginvestmentclimate.org), despite drastically reduced tariffs. Angola, Bangladesh, Bolivia, Ghana, Mozambique, Peru, Uganda, and Jamaica experienced the same significant effect (Milner *et al.* 2008).

Table 2.5 Changes in real income

(in 2020)

	CFTA		CFTA+TF		CFTA+ PanArabFTA		CFTA+ PanArabFTA+TF		CFTA+ PanArabFTA+ EuroMedFTA		CFTA+ PanArabFTA+ EuroMedFTA+TF	
	%	USD billion	%	USD billion	%	USD billion	%	USD billion	%	USD billion	%	USD billion
China	0.0	-0.1	0.9	5.5	0.0	-0.1	0.9	5.4	0.0	-0.2	0.9	5.4
European Union	0.0	-0.2	0.9	16.8	0.0	-0.2	0.9	16.8	0.0	0.9	1.0	17.9
United States	0.0	0.0	0.3	5.3	0.0	0.0	0.3	5.3	0.0	0.0	0.3	5.4
North Africa	0.2	0.1	1.1	0.7	0.2	0.1	1.1	0.7	0.5	0.3	1.4	0.9
Algeria & Libya	-0.1	0.0	0.5	0.1	-0.2	0.0	0.5	0.1	-0.3	-0.1	0.3	0.1
Egypt	0.3	0.1	1.2	0.3	0.4	0.1	1.3	0.3	1.1	0.3	2.0	0.5
Morocco	0.3	0.0	1.3	0.1	0.0	0.0	1.1	0.1	-0.8	-0.1	0.3	0.0
Tunisia	1.0	0.1	3.0	0.2	0.9	0.0	2.8	0.2	2.7	0.2	4.7	0.3
Rest of Arab League	0.0	0.0	0.8	0.7	0.1	0.1	1.0	0.9	0.0	0.0	0.8	0.8
Rest of Africa	0.5	0.6	2.1	2.5	0.5	0.6	2.1	2.5	0.4	0.5	2.1	2.5
Central Africa	0.0	0.0	0.8	0.1	0.1	0.0	0.8	0.1	0.0	0.0	0.7	0.1
Western Africa	0.6	0.5	2.3	0.9	0.6	0.2	2.3	0.9	0.6	0.2	2.2	0.9
Eastern Africa	-0.1	0.0	2.0	0.5	-0.1	0.0	2.0	0.5	-0.1	0.0	1.9	0.5
Southern Africa	0.9	0.4	2.5	1.0	0.9	0.3	2.5	1.0	0.8	0.3	2.4	1.0
Emerging Industrialized Economies	0.0	-0.1	1.0	7.5	0.0	-0.1	1.0	7.5	0.0	-0.2	1.0	7.4
Rest of the World	0.0	0.0	0.8	11.4	0.0	-0.1	0.8	11.4	0.0	-0.1	0.8	11.3

(Note) TF is trade facilitation measures.
(Source) Authors' calculations based on the MIRAGE model

Moreover, it should be highlighted that any possible and relatively limited negative effects on real incomes in North African economies can potentially be offset through other fiscal reforms made possible by increases in trade volume and economic activity following the implementation of the various integration policies.

V. Conclusions

Across the different phases of their economic development, NACs have implemented various policies to promote structural transformation without significant success, particularly when their progress is compared with that made by East Asian developing countries. During the last decade, NACs have experienced stagnation in their manufacturing sectors and even undergone a certain degree of deindustrialization during the second part of this period. North Africa displays the highest level of MVA per capita among African regions at 276 US dollars, but its MVA accounts only for

one-tenth of its GDP. In addition, the region's manufacturing sector continues to grow at a slower pace than its economy.

The importance of manufacturing remains high for the future economic growth of developing countries. A limited number of developing countries have managed in the last decades to expand their industrial sectors and concentrate significant shares of the developing grouping MVA (Haraguchi *et al.* 2016, UNIDO 2016). However, North Africa has not expanded its industrial base during the last decade. Its contribution to global manufacturing remains marginal (Upadhyaya and Mirzaei Yeganeh 2015). The region has not witnessed an emergence of a vibrant manufacturing sector underpinning regional economic growth and driving significant structural transformation. Rather, industrial development shows different paces and patterns within the region. Algeria's and Libya's reliance on natural resources indicates their urgent need to diversify their economies. Tunisia, Egypt, and Morocco have witnessed their larger manufacturing sectors stagnate or even decline in the recent past. The political and social changes in the region and their strong dependence on a reduced number of markets (notably, the EU), which were hit by the 2008 economic and financial crisis, partly explain such a mitigated industrial performance.

Trade policy can make significant contributions to improved outcomes, particularly to increased processing, to lead to higher value-added. Regional trade agreements may constitute a key instrument to raise participation of NACs in global trade. The African continent's positive growth prospects, related to the rapid urbanization and growth of the middle class, may convert the CFTA into a viable opportunity for North African economies to boost their manufactured exports. Given NACs' traditional trade relations with Europe and, to a lesser extent, with the remaining Arab countries, this assumption

has been assessed as being well within the context of the GAFTA, including the countries of the League of Arab States, and the EUROMED process with the EU.

In this study, three sets of scenarios were empirically assessed using CGE modelling: (1) establishment of the CFTA without and with trade-facilitation reforms; (2) effective implementation of the GAFTA in the context of the CFTA without and with the adoption of trade-facilitation measures; and (3) fully operational EUROMED with GAFTA and CFTA also in place, without and with measures to facilitate cross-border trade.

Our findings indicate that, in absolute terms, CFTA's establishment would boost intra-African trade, with industrial products thereby being stimulated the most (with as much as 42.7 billion US dollars out of the 69.5 billion US dollars increase in intraAfrican trade found in industrial products alone), generating positive outcomes for Africa's industrialization. The industrial content of intra-African trade would expand further if trade-facilitation measures were improved in addition to the introduction of CFTA. Indeed, when trade-facilitation measures are adopted within the context of CFTA reform, intra-African trade in industrial products further increases by 14 billion US dollars. Focusing solely on the impact on intra-North African trade, the positive effects of CFTA and trade-facilitation reforms on industrialization would be even more pronounced.

A Pan-Arab FTA established in addition to the CFTA would further increase trade in industrial products for NACs as well as for other LAS countries. However, it is worth noting that the share of NACs' trade gains in industrial products would be noticeably reduced compared with those arising from the CFTA reform alone due to the strong increase in intra-Arab League trade (and especially exports and imports of NACs to/from Arab League partners) of not only mining/energy products but also food. In this

case, trade-facilitation measures tremendously matter for North African trade of industrial products, as this sector could experience the largest progression if trade-facilitation reforms are adopted, in relative terms, when compared with a situation without trade facilitation.

When a EUROMED FTA is established along with both CFTA and Pan-Arab FTA, considerable additional trade is generated. More precisely, exports to the EU and all other countries of the Mediterranean alliance—in particular, from NACs—will generally rise tremendously, especially if cross-border trade costs fall. However, while North African exports of industrial products still increase most in absolute terms with the establishment of EUROMED on top of the CFTA and GAFTA, the share of industrial products in North Africa's export gains will shrink under the sharp increase in food exports from North Africa to the EU following the formation of the EUROMED FTA.

In other words, it appears that each FTA configuration will, in relative terms, stimulate North African countries' exports from different main industries most. Whereas industrial products represent the largest share of North Africa's export gains to Africa in general (North Africa as well as the rest of Africa), mining and energy dominate North Africa's export gains to the rest of the Arab League, while food dominates North Africa's exports to the EU. This is largely attributable to the currently very different trade structures between North Africa and its partners from Africa, the Arab League and the EU.

Therefore, the establishment of the CFTA, accompanied by trade-facilitation measures, appears to be crucial in supporting the industrialization of North African economies. Indeed, if the GAFTA and EUROMED were to be established without the CFTA in place, then the pro-industrialization effects would be much more marginal for North

African economies. Obviously, regional integration reforms that offer clear newmarket opportunities for North African nations come with a cost, as they generate tariff revenue losses that can mitigate real income effects (some countries being affected more negatively than others). However, complementary policies such as adoption of tradefacilitation measures are critical to guaranteeing better distributed outcomes and real income gains for all NACs specifically and all African economies in general. These measures also help to boost further intra-regional trade and export-led industrialization considerably. These outcomes will, of course, only be possible if (1) adjustment efforts are made to tackle tariff revenue contractions at the country level (including efforts to limit illicit financial outflows through trade mispricing; see Mevel et al. 2014), (2) exemptions from trade liberalization efforts (such as so-called sensitive products) are prohibited or strictly limited, (3) reforms are fully implemented and effective, and (4) coordination is improved between trade and industrial policy. Furthermore, trade-facilitation reforms will have the maximum impact if an important endeavor is simultaneously undertaken in trade infrastructure (WTO 2015); highlighting the key importance of allocating financial resources devoted to these efforts. Generalizing the establishment of common funds and regional development banks to finance key infrastructure projects and other projects aiming at easing trade across borders will be of major importance, as they often benefit a large number of countries and facilitate the development of regional value chains. Against this background, aid for trade projects, in particular, should focus more on boosting intra-regional trade.

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Appendix 2.1 Geographic decomposition for the modeling

	Country/Region	Main region
1	Egypt	North Africa
2	Morocco	North Africa
3	Tunisia	North Africa
4	Rest of North Africa (i.e. Algeria and Libya)	North Africa
5	Central Africa	Rest of Africa
6	Western Africa	Rest of Africa
7	Eastern Africa	Rest of Africa
8	Southern Africa	Rest of Africa
9	Rest of Arab League	Rest of Arab League
10	European Union	European Union (28 members)
11	United States	United States
12	China	China
13	Emerging industrialized	Emerging industrialized economies
14	Rest of the world	Rest of the world

Appendix 2.2 Sectoral decomposition for the modeling

	Sector	Main sector
1	Agriculture	Agriculture
2	Dairy products	Processed food
3	Meat products	Processed food
4	Vegetable oils and fats	Processed food
5	Processed rice	Processed food
6	Sugar	Processed food
7	Other food products	Processed food
8	Beverages and tobacco	Processed food
9	Other energy	Mining and energy
10	Crude and refined oil	Mining and energy
11	Mining	Mining and energy
12	Fishing	Industry
13	Forestry	Industry
14	Textiles	Industry
15	Wearing apparel	Industry
16	Leather products	Industry
17	Wood products	Industry
18	Paper products	Industry
19	Chemicals, rubber and plastic products	Industry
20	Mineral products	Industry
21	Iron and steel	Industry
22	Other metal products	Industry
23	Motor vehicles and parts	Industry
24	Transport equipment	Industry
25	Electronic equipment	Industry
26	Machinery equipment	Industry
27	Other manufacture	Industry
28	Other services	Services
29	Transport services	Services

Appendix 2.3 Changes in bilateral trade, following the CFTA

(%, in 2020)

	China	European Union	United States	North Africa	Rest of Arab League	Rest of Africa	EIE	Rest of the World
China		0.1	0.1	-0.7	0.1	-8.2	0.1	0.1
European Union	-0.1		0.0	0.9	0.0	-3.5	0.0	0.0
United States	-0.1	0.0		0.4	0.0	-1.7	0.0	0.0
North Africa	-1.5	-1.6	-0.7	73.1	-2.6	126.1	-1.3	-2.2
Algeria & Libya	-0.1	0.0	0.1	33.6	2.6	146.4	0.1	0.1
Egypt	-1.9	-2.7	-2.3	88.2	-2.8	77.2	-3.1	-2.7
Morocco	-3.5	-2.7	-2.5	26.1	-5.2	240.8	-2.4	-2.7
Tunisia	-6.8	-6.2	-6.4	116.1	-6.3	127.4	-5.9	-6.2
Rest of Arab League	0.0	0.0	0.2	-0.5	0.1	-4.4	0.1	0.0
Rest of Africa	-1.2	-3.6	-2.8	114.3	-2.3	72.7	-4.0	-3.9
Central Africa	0.5	1.7	0.6	165.9	1.6	62.8	0.9	1.0
Western Africa	-3.7	-3.2	-3.2	59.1	-3.6	126.3	-3.4	-3.3
Eastern Africa	1.0	2.4	1.1	38.8	3.5	39.6	1.9	2.2
Southern Africa	-6.1	-8.6	-9.5	284.6	-9.5	58.1	-10.3	-9.0
Emerging Industrialized Economies	0.0	0.1	0.1	-1.5	0.0	-6.6	0.1	0.1
Rest of the World	-0.1	0.0	0.0	-0.6	0.0	-1.3	0.0	0.0

(Source) Authors' calculations based on the MIRAGE model.

Appendix 2.4: Changes in bilateral trade, following the CFTA reforms

(US$ billion, in 2020)

	China	European Union	United States	North Africa	Rest of Arab League	Rest of Africa	EIE	Rest of the World
China		1.1	0.8	-0.2	0.1	-5.5	0.3	1.4
European Union	-0.2		0.2	-1.1	0.0	-5.2	-0.1	0.2
United States	-0.2	0.0		0.1	0.0	-0.6	-0.2	-0.1
North Africa	-0.2	-2.8	-0.3	7.1	-0.3	6.5	-0.5	-0.6
Algeria & Libya	0.0	0.0	0.0	1.2	0.0	0.5	0.0	0.0
Egypt	-0.1	-0.9	-0.2	2.4	-0.2	2.3	-0.3	-0.3
Morocco	-0.1	-0.5	-0.1	-0.2	-0.0	2.9	-0.1	-0.1
Tunisia	0.0	-1.4	-0.1	3.3	0.0	0.8	-0.1	-0.2
Rest of Arab League	0.0	0.0	0.2	-0.1	0.0	-1.0	0.2	0.2
Rest of Africa	-1.0	-4.5	-2.8	3.8	-0.3	52.0	-2.3	-2.7
Central Africa	0.2	0.3	0.2	0.4	0.0	2.2	0.1	0.1
Western Africa	-0.4	-1.2	-1.6	0.7	-0.1	25.3	-1.0	-0.4
Eastern Africa	0.2	0.6	0.1	0.5	0.2	7.2	0.1	0.4
Southern Africa	-1.0	-4.1	-1.4	2.3	-0.4	17.3	-1.4	-2.7
Emerging Industrialized Economies	0.0	0.5	0.7	-0.5	0.0	-3.5	0.1	0.5
Rest of the World	-0.1	0.0	0.3	-0.2	0.0	-1.0	-0.1	0.0

(Source) Authors' calculations based on the MIRAGE model.

Appendix 2.5 Changes in trade after the CFTA reforms with trade-facilitation

(%, in 2020)

	China	European Union	United States	North Africa	Rest of Arab League	Rest of Africa	EIE	Rest of the World
China		8.9	5.6	7.0	7.2	6.0	13.9	9.7
European Union	8.7		3.1	3.2	1.9	0.8	7.3	5.9
United States	9.9	3.9		1.7	2.1	2.5	7.3	6.7
North Africa	-0.6	2.5	0.8	87.0	3.1	137.9	0.2	-0.2
Algeria & Libya	-3.2	2.9	1.4	38.2	10.3	151.5	4.3	-1.2
Egypt	4.5	3.1	-0.9	101.8	3.3	91.5	-5.8	0.6
Morocco	1.6	3.2	0.6	39.3	-3.4	247.7	-4.2	1.8
Tunisia	-3.6	-0.7	-4.0	142.3	-4.2	139.5	-5.9	-4.7
Rest of Arab League	3.5	5.4	-0.2	9.6	14.9	5.7	0.9	4.0
Rest of Africa	2.8	3.1	0.8	131.5	3.0	95.2	-2.0	4.3
Central Africa	3.1	9.5	3.9	228.4	13.4	69.4	2.1	3.5
Western Africa	-0.5	3.2	-0.2	67.9	-2.3	136.7	-2.4	7.8
Eastern Africa	7.0	9.0	7.3	55.5	12.6	66.6	7.7	11.3
Southern Africa	0.5	-1.8	-4.6	301.7	-8.5	87.7	-7.2	-0.8
Emerging Industrialized Economies	9.9	5.9	5.8	2.6	5.3	3.1	13.6	10.6
Rest of the World	10.2	3.7	4.9	1.4	4.2	2.7	8.9	6.2

(Source) Authors' calculations based on the MIRAGE model.

Appendix 2.6 Changes in trade after the CFTA reforms with trade-facilitation

(US$ billion, in 2020)

	China	European Union	United States	North Africa	Rest of Arab League	Rest of Africa	EIE	Rest of the World
China		63.2	41.8	2.2	5.6	4.0	42.6	97.9
European Union	29.0		18.1	3.8	3.3	1.2	37.5	65.3
United States	19.4	17.3		0.4	1.4	0.9	26.9	54.4
North Africa	-0.1	4.3	0.4	8.5	0.4	7.1	0.1	-0.1
Algeria & Libya	-0.2	2.8	0.5	1.3	0.1	0.5	1.0	-0.1
Egypt	0.1	1.0	-0.1	2.8	0.3	2.7	-0.7	0.1
Morocco	0.0	0.6	0.0	0.3	0.0	3.0	-0.2	0.1
Tunisia	0.0	-0.2	-0.1	4.1	0.0	0.9	-0.1	-0.1
Rest of Arab League	3.1	6.8	-0.2	1.5	9.1	1.3	1.3	13.2
Rest of Africa	2.4	3.8	0.8	4.4	0.3	68.1	-1.1	3.0
Central Africa	1.2	1.5	1.2	0.6	0.1	2.5	0.2	0.3
Western Africa	-0.1	1.2	-0.1	0.8	0.0	27.3	-0.7	1.0
Eastern Africa	1.2	2.0	0.4	0.7	0.6	12.1	0.5	1.9
Southern Africa	0.0	-0.9	-0.7	2.5	-0.3	26.1	-1.0	-0.3
Emerging Industrialized Economies	30.6	29.3	33.0	0.8	4.6	1.6	36.5	59.6
Rest of the World	146.4	47.0	50.1	0.6	5.7	2.1	51.6	88.4

(Source) Authors' calculations based on the MIRAGE model.

Appendix 2.7 Main sectors of NACs' exports to destinations

(%, 2010~2012)

		NACs	Rest of Africa	Rest of the world
NACs	All food items	17.5	24.7	4.6
	Agricultural raw materials	1.0	2.3	0.5
	Ores and metals	3.3	3.3	2.4
	Fuels	36.0	12.2	71.4
	Manufactured goods	42.2	47.5	19.5
	Others n.e.c.	0.0	9.9	1.5
Algeria	All food items	2.7	32.1	0.4
	Agricultural raw materials	0.0	0.0	0.0
	Ores and metals	0.5	1.5	0.3
	Fuels	93.6	57.9	98.6
	Manufactured goods	3.2	8.5	0.8
	Others n.e.c.	0.0	0.0	0.0
Egypt	All food items	24.1	20.6	12.4
	Agricultural raw materials	1.5	4.0	2.1
	Ores and metals	7.0	4.4	5.9
	Fuels	4.2	3.5	39.7
	Manufactured goods	63.2	44.4	37.2
	Others n.e.c.	0.0	22.7	2.8
Libya	All food items	0.5	0.4	0.0
	Agricultural raw materials	0.6	0.7	0.0
	Ores and metals	1.1	0.2	0.1
	Fuels	63.1	0.5	97.0
	Manufactured goods	34.7	98.2	2.0
	Others n.e.c.	0.0	0.0	0.8
		NACs	**Rest of Africa**	**Rest of the world**
Morocco	All food items	16.7	32.8	17.8
	Agricultural raw materials	4.3	1.1	1.2
	Ores and metals	7.3	2.1	11.9
	Fuels	6.8	9.6	4.4
	Manufactured goods	64.4	54.3	63.7
	Others n.e.c.	0.5	0.0	0.9
Sudan	All food items	82.3	5.5	4.7
	Agricultural raw materials	14.1	0.2	1.3
	Ores and metals	0.2	0.3	0.6
	Fuels	0.0	88.6	74.5
	Manufactured goods	3.3	5.2	1.1
	Others n.e.c.	0.0	0.2	17.8
Tunisia	All food items	32.9	26.4	6.2
	Agricultural raw materials	0.3	1.4	0.5
	Ores and metals	1.4	4.7	1.6
	Fuels	1.1	0.7	17.1
	Manufactured goods	64.4	66.8	74.7
	Others n.e.c.	0.0	0.0	0.0

(Source) Authors' calculations based on UNCTADStat; accessed on 1 May 2015.

ARTÍCULO 3: HOW GREEN IS MANUFACTURING? STATUS AND PROSPECTS OF NATIONAL GREEN INDUSTRIALISATION. THE CASE OF MOROCCO

How green is manufacturing? Status and prospects of national green industrialisation. The case of Morocco

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Abstract

This paper reviews the concept of green industry. Our study introduces an innovative methodology to analyse green industrial development at country level by constructing an original database and looking at both green industrial production and employment data derived from UNIDO's industrial statistics database (INDSTAT). We use our methodological approach to review the status and analyse the prospects of green industrialisation in a selected set of countries. We conclude that countries have not seized yet the opportunities offered by green industry. We undertake a closer analysis of the green performance of Morocco, a country that has failed in the past to boost industrial development despite having put in place an ambitious green industrial policy. Our analysis suggests that green industrialisation offers an untapped potential that developing countries might use in the future as an alternative path to operate their structural transformation within the framework of the existing international industrial development setting.

Keywords: green industry; green manufacturing sector; industrial production; industrial employment; industrialisation; Morocco.

1 Introduction

Structural change drives economic growth and takes place by shifting from lower to higher productivity sectors; traditionally, such shifts occurred mainly from agriculture,

to industry and services. Manufacturing continues to offer today plenty of prospects for the future growth of developing countries but most benefits from industrialisation in the last years have been reaped by a handful of countries (UNIDO, 2016a; Haraguchi et al., 2016). Moreover, recent successful industrialisation experiences have occurred at a faster pace than in the past (Haraguchi, 2015). The introduction of policies tailored to specific conditions (UNIDO, 2013a; Lall, 2004) and their ability to seize the prospects offered by globalisation, among other factors, might explain their success.

The international community has long acknowledged the need to ensure sustainable development. The latter was defined as far back as 1987 as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland et al., 1987). In recent years, we have witnessed the upsurge of multiple calls to 'greening' our world, with their emphasis placed on different areas such as the economy as a whole, the manufacturing sector, jobs and investment (UNEP, 2011a; UNIDO, 2011; UNEP/ILO/IOE/ITUC, 2008; Eyraud et al., 2011). It is also worth mentioning the emergence of multi-partners initiatives seeking to support national efforts to green the economy, such as the UN-led partnership for action on green economy and the broader green growth knowledge platform. Research also pays significant attention to the above-mentioned green-related issues as well as to their prospects and limitations (Babonea and Joia, 2012; Bina, 2013; Bailey and Caprotti, 2014; Borel-Saladin and Turok, 2013b; Loiseau et al., 2016; Newton and Cantarello, 2014).

The sustainable development goals (SDGs) adopted in September 2015 by the UNGA (2015) constitute a significant breakthrough and are the proof of the growing consensus regarding the necessity as well as the feasibility of reconciling economic growth, respect for our planet and the social dimension of development. In the same line, it is

worth mentioning the introduction of individual SDGs dealing with economic growth, industry, responsible production and climate, respectively.

Today, more than ever before, not only do developing countries seek to speed up their structural transformation by industrialising and thus spur their economic growth, but they also reduce, at the same time, the use and depletion of natural resources and the negative impact of industrialisation might have on the environment and the climate. The above is compounded by gradually stringent international environmental conventions, fierce global competition and increasing pressure on consumers. This paper stems from our observation that despite the multiple existing definitions and calls for greening various economic facets of our world, there have been very few attempts to measure systematically the importance and potential of such endeavours, notably when it comes to green industry. The objective of our study is thus to develop an innovative approach to measure green manufacturing at the country level.

This paper is structured as follows: following this overall introduction, Section 2 presents a selected range of noticeable green-related concepts, with special emphasis on green industry. Section 3 introduces the methodology we have developed to measure green manufacturing in terms of both manufacturing value added (MVA) and employment. Section 4 presents and discusses selected results of our analysis. Our paper concludes with Section 5, where we present our main conclusions and a set of recommendations for future research as well as for policy-makers.

2 Some concepts: from green economy and growth to green industry and manufacturing

The Rio Declaration (UNGA, 1992) underlined back in 1992 the importance of the three pillars of sustainable development, namely social, economic and environmental. Before that, *The Pearce report* (Pearce et al., 1989) had introduced the concept of green

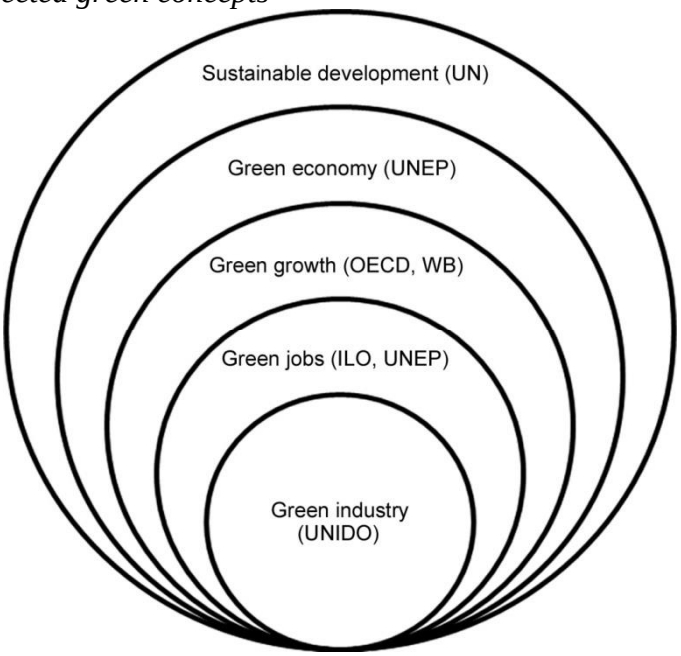
economy and developed possible approaches for valuing the environment. It is noticeable the growing popularity since then of environmentally related, green concepts as well as the lack of global consensus around those definitions. It is also worth stressing that the media have increased significantly the coverage of such subjects – for instance, Kouri and Clarke (2014) looked at coverage in media of green jobs. It is remarkable that consumers' pressure has resulted in the emergence of new economic activities such as green marketing (Dande, 2012), as proven by the introduction of new green brands.

This paper does not set out to undertake a systematic and exhaustive literature review of greening-related concepts as other authors have done it already (UNDESA, 2012). In this section, we focus rather on a limited set of such concepts as green economy, green growth and green jobs, which are relevant to introduce the focus of our research, i.e., green industry (Figure 1).

The OECD (2011) defines green growth as "fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, it must catalyse investment and innovation, which will underpin sustained growth and give rise to new economic opportunities". The World Bank (WB) (2012) focuses rather on inclusive green growth, growth that is efficient in the use of natural resources, clean in minimising pollution and environmental impact, and persistent in accounting for natural hazards and the role of environmental management and natural capital in preventing physical disasters. And, it has to be inclusive so it contributes to poverty alleviation. As such, inclusive green growth is viewed as the path to sustainable development. However, inclusive green growth has to combine economic, social and environmental dimensions. This will increase the complexity of measurement and monitoring and no

single indicator will be enough to track progress towards inclusive green growth (GGKP, 2016; Bouma and Berkhout, 2015), especially in the context of the SDG. It is difficult to think of a combined way of measuring all these three dimensions and, furthermore, this will differ from country to country depending on their priorities and capacities (see GGKP, 2013). We will come back to this in the conclusions section, when outlying the future line of work.

Figure 3.1 Selected green concepts



Finally, UNEP (2011a) defines a green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities". The role of greening the economy to achieve sustainable development is also underlined. Borel-Saladin and Turok (2013b) undertake a comparative analysis of the understanding by UNEP, the World Bank and OECD of the green economy to underline that they all agree that it is a leading approach to achieve sustainable development and as a key contributor to poverty reduction. The same authors (Borel-Saladin and Turok, 2013a) look at the impact of the green economy on

jobs in South Africa that seems to be positive but underline the question about how to finance green growth. This is a recurrent question addressed by other authors such as UNEP (2011a), which points out the need for new and innovative financing mechanisms such as the Green Climate Fund. The latter was established in 2010 and seeks to raise US$ 100 billion per year by 2020 to support mitigation and adaption in the developing world.

When it comes to the measurement of green economy and growth, such organisations as the European Commission (2009), the Green Growth Knowledge Platform (GGKP) (2013), the OECD (2009, 2014) and UNEP (2012) try, with varying degrees of success, to fill the lack of a robust and comprehensive set of indicators capturing the various facets of both concepts. Nahman et al. (2016) develop and test a composite green economy index based on 26 indicators to measure the green economic performance of countries. As will be presented later, our study proposes and tests an original methodology to measure the green industrial performance of countries.

Another important concept in the framework of our analysis is that of green jobs. The latter can be defined as "work in agricultural, manufacturing, research and development, administrative and service activities that contribute substantially to preserving or restoring environmental quality" (UNEP/ILO/IOE/ITUC, 2008). UNEP (2011a) concludes that the transition towards a green economy will result in the long run in the creation of additional jobs, notably in such sectors as agriculture, buildings, forestry and transport. In the case of manufacturing, the direct impact on jobs might be neutral or even negative but its indirect effects are significantly positive (UNEP, 2011b). It might be worth defining green entrepreneurship, which according to UNEP (2011c) is entrepreneurship taking place in green sectors.

The US Bureau of Labour Statistics (US Federal Registry, 2010) developed a relevant statistical definition of green jobs. Green jobs are those in businesses "involved in economic activities that help protect or restore the environment or conserve natural resources" or those in which "workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources". They include such activities as renewable energy, energy efficiency and greenhouse gas reduction. This definition is in line with that, previously introduced by UNIDO, of green industry that focuses exclusively on the manufacturing sector. Green industry (UNIDO, 2009, 2011) refers thus to industrial production with no negative impact on natural systems or human health. UNIDO proposes a twofold approach to support the emergence of such green industry that limits the depletion of natural resources and the increase of pollution: in the first place, greening existing industries through, for instance, a more efficient use of resources, the introduction of renewable energy sources, the elimination of toxic substances and the use of environmentally sound technologies; on the other hand, creating brand new green industries, i.e., industries that produce environmental goods or delivering green services including, among others, recycling and waste treatment. On the basis of the above-mentioned twofold approach to the greening of industries and the creation of new green industries, UNIDO launched its Green Industry Initiative as a response to the Manila Declaration on Green Industry in Asia and the request to support the related framework for action (The International Conference on Green Industry in Asia, 2009). Recent research (UNIDO, 2016a) confirms that, in general, countries industrialise by moving towards emission-reducing sectors as high-tech sectors display the highest environmental productivity.

The challenge of measuring green industry remains unsolved. Being able to estimate the size, and growth as well as the sectoral contributions of green industry to value added

and job creation is of capital importance. The hope that green industry will make a substantial contribution to underpin and reconcile economic growth, job creation and sustainability is to be tested using a systematic and comparable quantitative approach. This paper constitutes a significant attempt in that direction and develops and tests a methodology to estimate the size and contributions of green manufacturing.

3 Methodological approach: measurement of green manufacturing

The development of a clean, energy-efficient manufacturing sector, sometimes referred to as 'green manufacturing', is of prime importance to governments. As we have seen in Section 2, the development of green businesses and products is encouraged by governments and international institutions in the hope that it will result in the creation of green jobs, which are, in turn, expected to offer higher remuneration. As mentioned in the previous sections, the interest in estimating the size of the green economy and manufacturing in recent years has increased significantly, but has not been accompanied by systematic approaches to measure it. Previous analyses focused mainly on the ongoing structure and future growth of the green manufacturing sector. Of particular relevance is measuring the relative importance of green industrial production, i.e., the share of green industrial production in the overall manufacturing production. Policy-makers are particularly interested in the potential future growth of the green manufacturing sector, as it is often viewed as a potential engine of growth and development. Eberts (2011) presents a straightforward conceptual framework to define green industries and green jobs. As described in Section 2, most existing definitions include references to the conservation of energy and other natural resources or to the reduction of pollution. Such different criteria as environmentally friendly and enhancing products and services or renewable energy products and services are used to

identify products and services that belong to the green economy. In his work, Eberts (2011) describes three studies that use different methodologies to estimate the size of the green economy and its growth. All three focus on US states and local areas using national statistical data. A noteworthy innovative contribution of our study is that it calculates estimates of green manufacturing at global level by devising a methodology applicable to different countries using internationally available databases. The applications for policy-making of our proposed methodology are vast and will contribute to shed light on the expectations one can place on green manufacturing as a leading contributor to economic growth and sustainability.

The prominent report 'Measuring the green economy' produced by the US Department of Commerce (2010) introduces a remarkable approach to identify and assess green products and services based on both energy conservation and environmental goals. According to that report, a product or service is considered green if it serves predominantly one or both of the following goals: (i) conserve energy and other natural resources, reduce fossil fuel use and promote water, raw material, land and species and ecosystem conservation; or (ii) reduce pollution, i.e., include products and services that provide clean energy or prevent, treat, reduce, control or measure environmental damage to air, water and soil; also, in this category fall those products and services related to remediation, abatement, removal, transportation or storage of waste and contaminants. The report categorises that green products and services are in five environmental activities, which are as follows:

- resource conservation
- environmental assessment
- energy conservation
- renewable/alternative energy

- pollution control

The above-mentioned study uses the 2007 economic census, which includes the private sector and excludes the government sector. However, the government sector accounts for almost 13% of the gross domestic product (GDP), which is one of the limitations of this report. The US NAICS (US Census Bureau, 2007) industries are identified by a six-digit code. The six-digit code accommodates a large number of sectors allowing analysts more flexibility in designing subsectors. Each product or service is assigned a 10-digit code. The product coding structure represents an extension, by the US Census Bureau, of the six-digit industry classifications of the manufacturing and mining sectors. The classification system operates in such a way that the industrial coverage is progressively narrower with the successive addition of digits. More than 22,000 products and services from the 2007 census were examined. As a general rule, the usage of a product was considered, when deciding on its greenness, not the process of its production or the consequences for the environment of its disposal. Two levels of categorisation are applied, namely 'narrow', i.e., products for which wide agreement for classification as green was assumed, and 'broad', i.e., products and services for which the classification as green was more prone to be debated. Finally, the exercise concludes with 497 and 732 products and services identified as green using the narrow and broad definitions, respectively. In the framework of our study, we decide to use 87 identified products that fall, according to the broad definition, into the manufacturing category. The methodological approach we put forward in this paper uses exclusively those 87 green manufacturing products.

It is worth stressing that MVA and employment (number of employees) in the manufacturing sector constitute suitable indicators to measure the size of the green

manufacturing sector. Those two leading indicators are at the core of the methodology we develop to measure green manufacturing.

The MVA is defined as the value of output less the value of input. Items covered in the latter include:

- the value of materials and supplies for production (including cost of all fuels and electricity purchased)
- the cost of services received (mainly payments for contract and commission work and repair and maintenance work).

If input estimates are compiled on a 'received' rather than on a 'consumed' basis, the result is adjusted for the net change between the beginning and the end of the period in the value of stocks of materials, fuel and other supplies. Total value added is the national accounting concept. It is ideally represented by the contribution of the establishments in each branch of activity to the gross domestic product. Whenever census concept is applied, for the measure of total value added, the cost of non-industrial services is deducted and the receipts for non-industrial services are added to census value added. The estimates, whether in terms of census value added or total value added, are gross of depreciation and other provisions for capital consumption, unless otherwise stated. The valuation may be at factor costs, at basic prices or at producers' prices, depending on the treatment of indirect taxes and subsidies as described earlier.

The number of persons engaged is defined as the total number of persons who worked in or for the establishment during the reference year. Home workers are excluded. The concept covers working proprietors, active business partners and unpaid family workers as well as employees. The figures reported refer normally to the average number of persons engaged during the reference year, obtained as the sum of the 'average number

of employees' during the year and the total number of other persons engaged measured for a single period of the year. The number of employees is intended to include all persons engaged other than working proprietors, active business partners and unpaid family workers.

The above-mentioned two indicators are readily available from an annual industrial survey or census of manufacturing. UNIDO maintains a global industrial statistics database INDSTAT (UNIDO, 2016b), which contains these two indicators together with six other variables, namely the number of establishments, gross output, wages and salaries, gross fixed capital formation, number of female employees and the index of industrial production.

In our study, we use the list generated by US Department of Commerce study and map the green products to the manufacturing industries, identified at four-digit ISIC Revision 3.1 code (United Nations, 2002), which produce them. While we acknowledge such a mapping is not absolutely precise, as we move from 10-digit product codes to six-digit NAICS economic activity codes and further to four-digit economic activities codes, we suggest using this approach as a first approximation for measuring the green manufacturing. We further combine these results with the UNIDO INDSTAT database, which contains data on production and employment for more than 140 countries in the last 20 years.

If one or several green products are produced in a factory classified by a four-digit ISIC, this does not mean necessarily that this four-digit ISIC is green since other products might be produced in the same factory or in others, which are classified in the same four-digit ISIC code. For example, "Parts for bicycles, unicycles and adult tricycles (3369912105)" are classified as green and fall into NAICS (2007) "336991=Motorcycle, Bicycle, and Parts Manufacturing", which in turn is classified as

"3591=Manufacture of motorcycles" in ISIC Revision 3. It is clear that only part of ISIC 3591 can be considered green. It would be ideal to have access to the survey microdata and compute the share of green products in the total production of the factory and then aggregate to the corresponding activity code. However, this type of data is seldom available to researchers. It is known that there is a strong relationship between domestic production and international trade, which allows us to measure the overall economic performance and growth through measuring the export diversification (Fotros et al., 2013; Romeu and da Costa Neto, 2011). For this purpose, usually the Herfindahl index is used (Hesse, 2008). The two facets of diversification are equally important; however, the latter is often used as a proxy for the economic growth since international trade data are more readily available than data on domestic industrial production. Inspired by this, we propose to use as a rough proxy the share of exports of a given green product in the total exports of the corresponding economic activity where this product belongs. For the purpose of calculating these shares, we use the UN COMTRADE database (United Nations, 2016) and convert the NAICS product codes to the HS codes and then further to activities coded in ISIC.

The innovative methodology we propose to introduce and test in this paper to measure green manufacturing can thus be summarised as follows:

- use the list of green products identified by the study of the US Department of Commerce
- convert 10-digit product codes to six-digit NAICS activity codes
- convert six-digit NAICS activity codes to four-digit ISIC Revision 3 codes
- apply to the UNIDO INDSTAT 4 database
- compute value added (VA) and employment (EMP) of green industry
- adjust using UN COMTRADE data
- adjust by national survey data where possible.

4 A preliminary analysis of green manufacturing

We apply the methodology introduced in Section 3 to the data available from international databases, namely UNIDO INDSTAT and UN COMTRADE for a group of countries. The application of our methodological approach results in the construction of a unique database that allows us to estimate the size and role of the green manufacturing sector at the country level. We present the results corresponding to six selected countries (see Table 1).

Table 3.1 Size of green manufacturing sector for selected countries: value added in 1000 USD and share in percent, 2010

Country	*VA (1000 USD)*	*EMP*	*Share VA*	*Share EMP*
USA	51,191,529	296,871	2.46	2.53
Japan	26,692,555	165,684	2.73	2.47
Brazil	3,304,250	71,940	0.85	1.01
Russian Federation	3,513,238	259,258	1.83	3.32
Egypt	357,116	21,484	1.8	2.17
Morocco	180,587	11,444	1.67	2.35

The data for USA is from 2008, since no more recent data in ISIC Revision 3 at 4-digit level were available.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

The study of the US Department of Commerce uses as a key measure the value of shipments/receipts. A more precise measure would be MVA but it can only be computed for the manufacturing sector. Since the Department of Commerce wants to analyse the complete economy, also including services, they prefer to use the value of shipment/receipts. In our study, we are interested only in the manufacturing sector so we decide to use value added as a key performance measure. Next to value added, we compute the estimated number of employees involved in the production of green

products. Table 1 also presents the share of value added and employment of the green manufacturing in the total manufacturing.

Our analysis estimates that in 2010 the value added generated by green products in the USA reaches US$ 51 billion and involves almost 300,000 employees – around double the corresponding values in the case of Japan. The Russian Federation and Brazil display similar levels of green value added at around US$ 3.5 billion while the difference in terms of green employment is striking. The above-mentioned estimates compare with US$ 181 million and 11,444 employees in the case of Morocco whose values are half of those of Egypt.

Table 1 also indicates that green products account for a value ranging from 0.85% in Brazil to 2.73% of the total manufacturing in Japan. It is worth mentioning that the shares of green MVA and employment in Japan are slightly higher than in the USA. It is also noteworthy that the share of employment devoted to the production of green products is slightly higher than the share of value added in all selected countries except for Japan.

We present in Table 2 the value added per employee in green manufacturing production and in the 'non-green' MVA as well as their ratio. We conclude from this table that the value added per employee is slightly higher in the green and non-green industries in the case of industrialised countries. In the other selected countries, the ratio is slightly lower than one, with the exception of the Russian Federation. If we assume that the wages/salaries per employee are related to the value added per employee, with higher pay in industries that have higher value added per employee, we can say that the green jobs are paid almost with the same as the non-green ones. Later, we will shed more light on the pay in green jobs in the case of Morocco, using the indicator wages and salaries, which are available in the industrial statistics database.

Table 3.2 Green and non-green value added per employee and the ratio of green to non-green, 2010

Country	*Green VA/EMP*	*Non-green VA/EMP*	*Ratio*
USA	172,437	171,663	1
Japan	161,105	141,357	1.14
Brazil	45,931	53,818	0.85
Russian Federation	13,551	24,950	0.54
Egypt	16,622	19,632	0.85
Morocco	15,780	22,103	0.71

The data for USA is from 2008, since no more recent data in ISIC Revision 3 at 4-digit level were available.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

With a view to testing our novel methodology with a concrete example, we decided to undertake, within our study, a closer examination of the green manufacturing sector of Morocco. The latter has been chosen for multiple reasons. One should start by stressing that, despite the policies to operate structural transformation, manufacturing continues to play a modest role in North Africa compared with other developing regions, and one can conclude that the region has partly deindustrialised (Moll de Alba, 2014; Mevel et al., 2016). The limited contribution of the manufacturing sector to the economies of the region, coupled with increasing pressure on the environment and the limited natural resources, suggest that green industry might constitute an alternative path to embark on the necessary structural transformation of the region and, at the same time, respond to the pressing environmental and resource limitations. The move towards a green economy is considered to offer promising prospects to reduce poverty and create employment in Africa; a number of African countries have adopted policies to support such a move (UNEP, 2015). It is worth mentioning the emphasis placed by Morocco on facilitating the move towards a green economy. Article 31 of the national Constitution

(Bulletin officiel du Royaume du Maroc, 2011) thus constitutes sufficient proof as it underlines the importance of ensuring access to water and a healthy environment, as well as sustainable development. The National Charter for the Environment and Sustainable Development (Secretariat d'Etat chargé de l'Eau et de I'Environnement, 2011) and the related Framework Law 99-12 (Bulletin officiel du Royaume du Maroc, 2014) seek to ensure environmental protection and sustainable development. National sectoral strategies such as the Industrial Acceleration Plan 2014–2020, the Morocco Green Plan, the National Energy Strategy, which seeks to attain 42% from renewables in the country energy mix, and the Vision 2020 for Tourism incorporate all the principles of sustainable development. The organisation of the 22nd session of the Conference of Parties (COP) in 2016 in Marrakech constitutes additional proof of Morocco's commitment to ensure sustainable development. A survey (UNECA, 2015a) on the practices of enterprises in the region concludes that small and medium-sized enterprises (SMEs) in the region lack the expertise and the finance to move towards the green economy and that uncertainty remains high owing to the lack of national green markets and of government incentives. While Morocco's national sustainable development strategy places green economy at its core, it would be advisable that the national industrial strategy integrates environmental needs so it contributes to the emergence of green industries (UNECA, 2015b). When it comes to green industrial policies, one might say that Morocco's strategy has decided to support such selected industries as concentrated solar power. Morocco's experience with energy subsidies also serves to illustrate the importance of understanding the impact of potential green growth strategies to decide on the most appropriate economic reforms (WB, 2012).

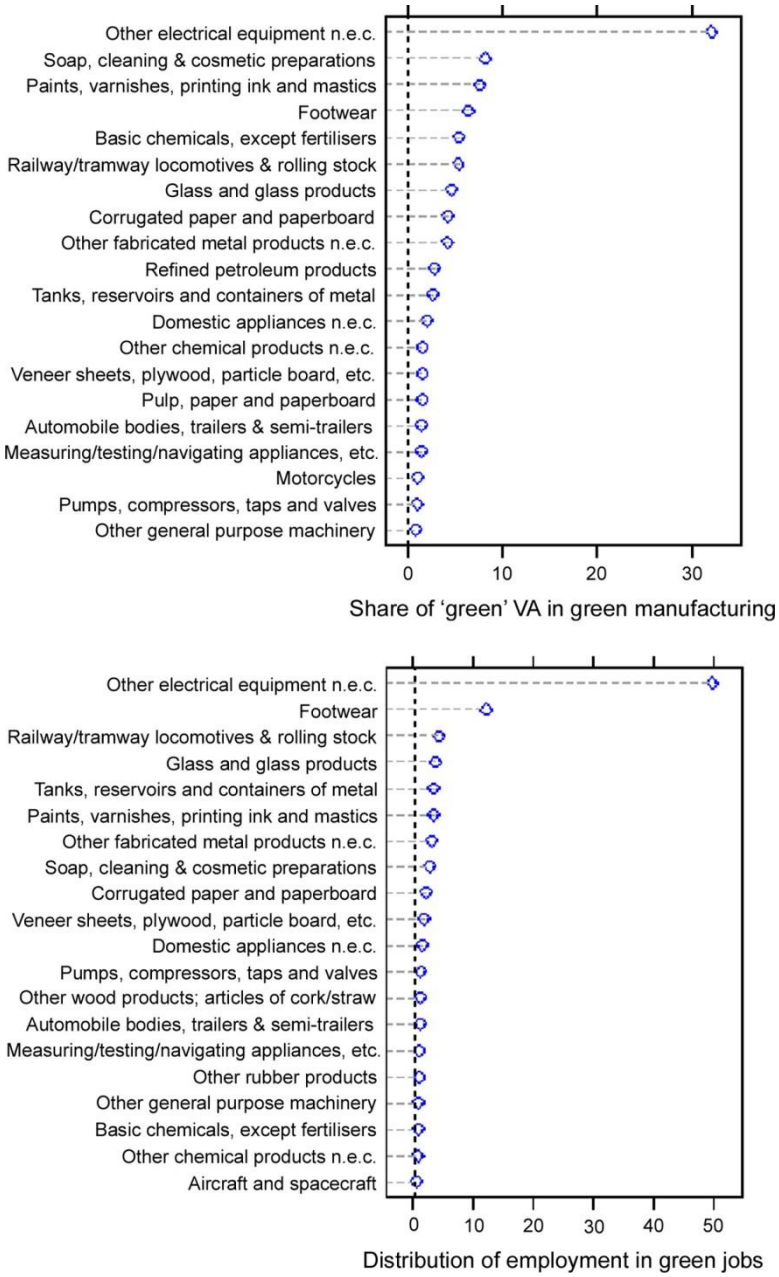
In the following paragraphs, we do present a succinct summary of the status of green manufacturing in the case of Morocco. For that purpose, we look at the share of green

value added and green employment in total manufacturing and in green manufacturing (Figure 2). We also undertake an analysis of the value added per employee, as well as of annual wages and salaries per employee in green manufacturing (Figure 3).

The first finding derived from our analysis of green manufacturing in Morocco is the strong concentration in a handful of industries in terms of both green MVA and green employment. One single activity, 'Other electrical equipment not elsewhere classified', accounts for half of the green employment and one-third of value added. Moreover, the top five contributors account for almost 70% of green employment and 60% of green value added. The top 10 green manufacturing activities contribute modestly to overall MVA and employment and account for 1.37 and 1.91%, respectively.

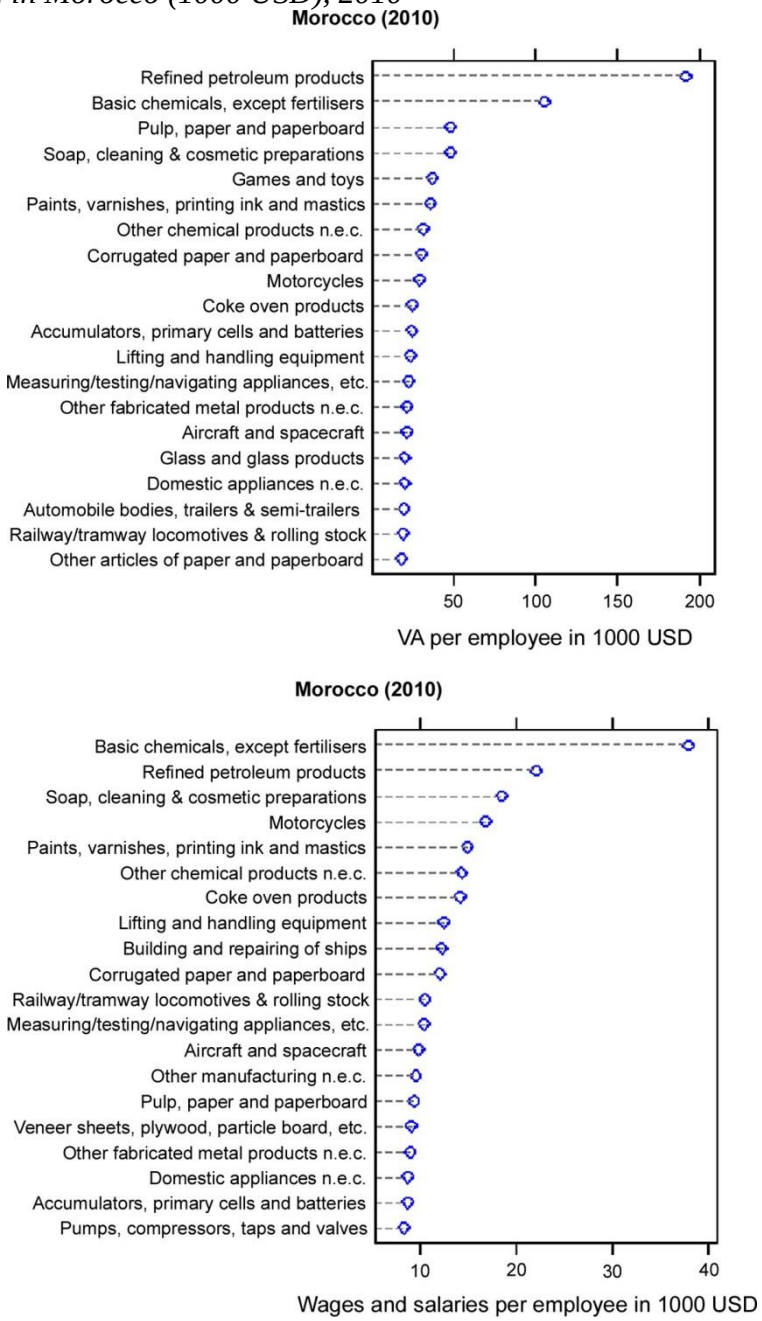
When looking at the value added and wages and salaries per employee in green manufacturing in the Kingdom of Morocco, one finds significant differences even if one focuses on the top green industries. It is thus worth noting that "Other electrical equipment not elsewhere classified", the top contributor to green value added and employment, reaches only US$ 10,063 of value added per employee and US$ 6087 of yearly wages and salaries. This compares with US$ 192,181 of value added per employee and US$ 22,094 of wages and salaries per employee in the refined petroleum products and US$ 105,813 and US$ 37,996 in basic chemicals, except fertilisers.

Figure 3.2 Distribution of green value added and employment across green industries in Morocco (share in percent from green manufacturing and employment), 2010



Industries according to ISIC Revision 3 at 2-digit level; 'n.e.c.' means 'not elsewhere specified'. Only the top 20 industries are shown.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

Figure 3.3 Value added and wages and salaries per employee in green manufacturing in Morocco (1000 USD), 2010



Industries according to ISIC Revision 3 at 2-digit level; 'n.e.c.' means 'not elsewhere specified'. Only the top 20 industries are shown.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

5 Conclusions and recommendations

The 1975 Lima Declaration (UNIDO, 1975) underlines the role of industrialisation necessary for "the rapid and economic and social development of developing countries", and the 2013 Declaration (UNIDO, 2013b) emphasises the relevance of such challenges as "the depletion of natural resources and the intensifying threats of environmental degradation and climate change", stressing the increasing recognition of the necessity to integrate "the economic, social and environmental dimensions of sustainable development". This paper starts by reviewing the emergence and relevance of green-related concepts such as green economy and growth (UNEP, 2011a; OECD, 2011; WB, 2012), with special emphasis on green industry (UNIDO, 2009). Our study makes a substantial contribution to bridge an existing gap, i.e., the lack of a systematic approach to measure green manufacturing at national level. For that purpose, we develop and introduce an advanced methodological approach to analyse green industrial development making use of green industrial production and employment data that we derive from UNIDO's INDSTAT database.

We construct an original dataset and use it to undertake a comparative analysis of the performance and potential of green industry across a set of countries. Our analysis seems to suggest that the size of green manufacturing is significantly larger in industrialised economies compared with selected BRICs and developing countries in our sample. Moreover, the relative size of green value added seems to follow a pattern similar to that of MVA at large. When looking at the shares of green manufacturing in MVA, our analysis suggests that the full potential of green manufacturing might remain to be realised, as green manufacturing accounts for from 1% to 3% of the overall MVA. Our analysis reveals differences between green and non-green industries in

industrialised and non-industrialised countries in terms of value added per employee. The latter is slightly higher in the case of industrialised countries.

We also undertake a more detailed analysis of the performance of Morocco to test and illustrate the potential offered by our methodology. Morocco, a North African country that, like the other countries in this region, has not succeeded in significantly expanding the industrial development in the past, places a strong emphasis on the transition to a green economy. Our analysis concludes that green manufacturing potential in Morocco might offer even greater potential, as the contribution of industries to green value added and green employment is comparatively lower than that of other selected countries, as well strong concentration in a limited number of economic activities. Moreover, we do find significant differences in terms of value added per employee and wages and salaries per employee in green manufacturing, even among the top contributors to green MVA.

Our study contains several limitations, which point to the need for future research, such as the approximation we use to map the green products to manufacturing industries, the very definition of green products, our focus on one year (2010) to test our approach and the limited geographical coverage. Future work will contribute to compare and link our methodology and analysis with other existing studies such as the environmental lists introduced by EUROSTAT and OECD (2009). Furthermore, since most of the countries move to reporting the manufacturing data in ISIC Revision 4, the green product and industry correspondence will benefit from being translated in ISIC revision 4.

For countries where access to survey data is possible, we also intend to investigate the adjustment of the estimates using these data. In addition, it would be of interest, provided data are available, to expand the coverage in terms of countries and time, and undertake comparative analyses. All the above should contribute to refine further our

methodology and provide more accurate estimates of the green manufacturing sector. It would also be interesting to look in detail at the sectoral contributions of green manufacturing and whether they differ between countries or follow a similar pattern. A related research line could contribute in the future to identifying and illustrating successful green industrialisation experiences and spell out their key driving factors. This would shed light on the different green manufacturing performance of countries. The analytical framework used traditionally to analyse industrial development at country level might benefit from refinement by including green-related issues and thus help to better understand the performance and potential offered by green industry to developing countries within the current international setting that does not allow those countries to simply follow the industrial development path used earlier on.

Our study seems to point towards the untapped potential offered by green manufacturing to developing countries and falls thus short of the expectations to support fully their industrialisation. It is worth mentioning that a process of green industrialisation might call for the establishment of a coherent policy mix that harmonises and reinforces mutually, among others, industrial and environmental policies. Moreover, the mere existence of such policies does not seem to suffice to guarantee the immediate emergence of green industry as the Moroccan experience seems to suggest.

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Appendix 3.1 Morocco: Share of green value added and green employment in total manufacturing and in green manufacturing respectively of the top 10 industries (four-digit ISIC Revision 3)

Economic activity	*Share in total manufacturing* (%)		*Share in 'green' manufacturing* (%)	
ISIC Description	*VA*	*Employment*	*VA*	*Employment*
3190 Other electrical equipment n.e.c.	0.54	1.17	32.13	49.76
2424 Soap, cleaning and cosmetic preparations	0.14	0.06	8.25	2.69
2422 Paints, varnishes, printing ink and mastics	0.13	0.08	7.54	3.23
1920 Footwear	0.11	0.29	6.38	12.2
2411 Basic chemicals, except fertilisers	0.09	0.02	5.43	0.8
3520 Railway/tramway locomotives and rolling stock	0.09	0.1	5.31	4.32
2610 Glass and glass products	0.08	0.08	4.55	3.52
2102 Corrugated paper and paperboard	0.07	0.05	4.21	2.18
2899 Other fabricated metal products n.e.c.	0.07	0.07	4.13	3.01
2320 Refined petroleum products	0.05	0	2.77	0.22
Total (top 10)	1.37	1.92	80.7	81.93

Industries according to ISIC Revision 3 at 2-digit level; 'n.e.c.' means 'not elsewhere specified'. Only the top 10 industries are shown.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

Appendix 3.2 Morocco: Green value added and green wages and salaries per employee respectively of the top 10 industries (four-digit ISIC Revision 3)

ISIC	*Description*	*VA/EMP* (*USD*)	*WS/EMP* (*USD*)
3190	Other electrical equipment n.e.c.	10,063	6,087
2424	Soap, cleaning and cosmetic preparations	47,795	18,457
2422	Paints, varnishes, printing ink and mastics	36,360	14,975
1920	Footwear	8,151	4,796
2411	Basic chemicals, except fertilisers	105,813	37,996
3520	Railway/tramway locomotives & rolling stock	19,166	10,491
2610	Glass and glass products	20,153	7,284
2102	Corrugated paper and paperboard	30,055	12,013
2899	Other fabricated metal products n.e.c.	21,355	8,952
2320	Refined petroleum products	192,181	22,094
	Total (top 10)	491,092	143,145

Industries according to ISIC Revision 3 at 2-digit level; 'n.e.c.' means 'not elsewhere specified'. Only the top 10 industries are shown.
Source: Authors' calculations based on UNIDO, INDSTAT 4 Industrial Statistics Database at 3- and 4-digit level of ISIC Revision 3 and 4. Available from http://stat.unido.org

CONCLUSIONES

CONLUSIONES DE LA TESIS DOCTORAL

El objetivo principal de esta tesis doctoral es analizar el estado y la evolución del desarrollo industrial e identificar posibles patrones en los países en desarrollo tomando como caso de estudio el Norte de África, analizando a continuación el efecto de los acuerdos comerciales y el papel potencial de la industria verde en el proceso de industrialización de dichos países. Para lograr dicho objetivo principal, la investigación se ha estructurado en torno a tres artículos académicos que conforman esta tesis doctoral. El primer artículo aborda el análisis y la identificación de "patrones de desarrollo industrial" a nivel regional. El segundo artículo se concentra en medir el impacto de posibles acuerdos de libre comercio regionales e identificar aquéllos más favorables al desarrollo industrial futuro. Finalmente, el tercer artículo analiza el papel de la industria verde a nivel nacional en términos tanto de producción como de empleo industrial.

En este apartado, se presentan las conclusiones fundamentales que se derivan de los tres artículos de investigación. Esta sección concluye con la presentación de las conclusiones generales de esta tesis doctoral y avanza eventuales líneas de investigación futura.

El primer artículo analiza el estado y evolución del desarrollo industrial en la región del Norte de África durante el período 2004-2012 en el que el continente africano experimentó un crecimiento significativo. La principal conclusión derivada de nuestro análisis es que la base industrial de la región del Norte de África continúa siendo comparativamente débil y que durante el período de referencia el sector industrial se ha estancado, por lo que se puede hablar de cierta desindustrialización de la región. Este

artículo realiza también una aportación significativa al identificar, en línea con estudios anteriores, dos patrones diferenciados de desarrollo industrial en el seno de la región. Los países ricos en recursos naturales de la región precisan una diversificación urgente de sus economías liderada por el crecimiento del sector industrial, mientras que los países de la región dotados de una base industrial significativa precisan revertir la tendencia de estancamiento de sus sectores industriales en el período estudiado con objeto de que sus economías crezcan de forma significativa en el futuro.

El segundo artículo se centra en analizar el impacto de la política comercial en la industrialización de la región del Norte de África mediante la introducción de posibles acuerdos regionales de libre comercio. La conclusión fundamental de este artículo indica que distintos acuerdos de libre comercio estimulan de forma diferente el comercio de los países de la región norte-africana. El artículo indica que un acuerdo de libre comercio continental (ALCC) apoyado por medidas de facilitación de comercio jugaría un papel crucial y estimularía de forma sustancial la industrialización del Norte de África, mientras que si se establecieran acuerdos comerciales con los países árabes y la Unión Europea sin la existencia del ALCC, el impacto sobre la industrialización de la región sería marginal.

El tercer artículo sirve para llevar a cabo un análisis comparativo del papel potencial de la industrialización verde en una serie de países que incluyen Marruecos como caso de estudio de la región del Norte de África. La principal conclusión del estudio realizado es que los países no aprovechan las oportunidades que la industria verde ofrece como vector de desarrollo industrial. El caso de Marruecos en la región norte-africana es particularmente característico al haberse dotado de una estrategia de desarrollo industrial verde que no ha conllevado el crecimiento de su base industrial. Este artículo aporta una metodología específica al introducir un nuevo enfoque para medir el

desarrollo industrial verde a nivel nacional basado en indicadores de valor agregado y empleo manufacturero verdes.

Las conclusiones generales de esta tesis doctoral que derivan de los tres artículos de investigación se presentan a continuación.

El análisis del estado y la evolución del desarrollo industrial de la región del Norte de África en el período de 2004 a 2012 no han experimentado un crecimiento sustancial, no habiendo aprovechado el 'boom' internacional de los mercados de materias primas para acelerar su transformación estructural.

Esta tesis doctoral identifica dos patrones diferenciados de desarrollo industrial en el seno de la región: por un lado Argelia y Libia, países ricos en recursos naturales y con una base industrial prácticamente inexistente y, por otro lado, Egipto, Marruecos y Túnez con una industria manufacturera más desarrollada.

Una conclusión fundamental de esta tesis doctoral que se deriva de la existencia de varios "patrones de desarrollo industrial" en la región es que las diferencias entre dichos patrones precisan estrategias diferenciadas para promover la transformación industrial de la región. Así, cabe reseñar tres estrategias básicas que pueden liderar el desarrollo industrial de la región: estrategias que cambien la estructura productiva y comercial de los países de la región; conclusión de acuerdos de libre comercio que fomenten las exportaciones de productos manufactureros; y, desarrollo de la industria verde.

Para que el desarrollo industrial de la región del Norte de África juegue un papel preponderante en la transformación estructural de dicha región se precisan cambios significativos en el crecimiento, complejidad y diversificación, tanto de la estructura productiva, como comercial de las manufacturas de la región norte-africana. Dicha estrategia debería centrarse en reducir la dependencia del comercio de materias primas

mediante la producción y comercio de productos manufactureros, así como en la diversificación, tanto de productos, como de mercados.

El análisis realizado confirma que los acuerdos de libre comercio regionales pueden realizar una contribución significativa para acelerar el proceso de industrialización de África del Norte. Eso sí, es fundamental subrayar que distintos acuerdos potenciales de libre comercio tienen un impacto diferente en el comercio de diferentes productos manufactureros. Por ejemplo, el acuerdo de libre comercio continental es el que genera mayores ganancias en el comercio de productos manufactureros de la región del Norte de África, mientras que los alimentos concentran las ganancias derivadas de acuerdos comerciales con la Unión Europea.

Del mismo modo, se concluye que los efectos de los acuerdos de libre comercio sobre los productos manufactureros de la región analizada se amplifican de forma relevante cuando se introducen de forma paralela medidas de facilitación del comercio.

Finalmente, el análisis realizado permite concluir que, a pesar del potencial y del interés generado, los países no aprovechan todas las oportunidades que ofrece la creación de una industria verde para impulsar el proceso de transformación estructural de sus economías. La industria verde, particularmente en el marco actual regido por una serie de acuerdos y reglas internacionales que ponen énfasis en la necesidad de conciliar el crecimiento económico con la sostenibilidad, parece ser propicio como vector dinamizador del desarrollo industrial de los países en desarrollo. La mera introducción de políticas de apoyo no implica necesariamente la aparición de una industria verde como lo prueba Marruecos, el caso de estudio en este ámbito utilizado en el marco de esta tesis doctoral.

Tras la presentación de las conclusiones generales de esta tesis doctoral conviene subrayar algunas limitaciones de los artículos de investigación que la conforman. El número limitado de países para los que se dispone de datos que permitan analizar el estado de su industria verde es limitado y Marruecos y Egipto son los dos únicos países de la región del Norte de África en la muestra del objeto de estudio. Por otro lado, el análisis del impacto de los acuerdos de libre comercio se apoya en bases de datos diferentes de las utilizadas en el análisis de la producción y comercio industrial y verde.

A partir de los trabajos realizados en el marco de esta tesis doctoral se identifican posibles nuevas líneas de investigación. En primer lugar, se podría considerar desarrollar un modelo que permita realizar de forma sistemática y simultánea el análisis del desarrollo industrial, el impacto de posibles acuerdos de libre comercio sobre los productos industriales y el potencial de la industria verde como vector de industrialización, así como su aplicación a diferentes regiones y países más allá del Norte de África. Del mismo modo, resultaría de interés llevar a cabo análisis similares para otros períodos temporales.

En segundo lugar, analizar las sinergias y la complementariedad entre las políticas industriales, comerciales y de apoyo a la industria verde abre un nuevo abanico de cuestiones de investigación. Dicho análisis se podría complementar con el estudio de casos que ilustren el impacto de dichas políticas sobre el proceso de desarrollo industrial de los países.

En tercer lugar, el desarrollo de un sistema de indicadores que permitan realizar el análisis de la industria verde a nivel de país abre múltiples oportunidades que contribuirían al proceso de desarrollo de políticas y a la toma de decisiones para apoyar el proceso de industrialización de los países.

En cuarto lugar, el desarrollo industrial, la integración regional y la industria verde precisan recursos humanos dotados de una serie de conocimientos y capacidades avanzadas determinadas por las empresas industriales, por lo que resultaría de utilidad identificar modelos de cooperación existentes entre el sector público y privado que faciliten la adquisición de dichos conocimientos y capacidades con objeto de posibilitar el desarrollo rápido y sostenido del sector industrial.

Para finalizar, resulta importante destacar la contribución de esta tesis doctoral al estado del arte sobre el papel que la evolución del sector industrial puede jugar como motor de desarrollo de los países en desarrollo.

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